Tax Competition among Governments and the Effects on Government Performance: Empirical Evidence from Local Governments in New Jersey

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This thesis addresses two fundamental issues highlighted in the literature on competition among governments: 1) Do local governments engage in tax competition? and 2) What are the effects of competition on government performance?

In a multi-level government system, we can observe two types of competition: inter-jurisdictional competition between the same level of governments and intra-jurisdictional competition between governments sharing the same tax base. To examine the presence of competition and the effects on government performance, we estimate several equations using data on New Jersey local governments. New Jersey is an optimal location to examine both types of competition simultaneously given its diversity in political institutions, its highly fragmented local governmental structure, and the property tax base sharing between municipalities, school districts, and counties.

This study contributes to the literature on government competition by examining the presence of both types of competition within a comprehensive framework and the effect of competition in terms of government efficiency. To investigate the presence of both inter- and intra-jurisdictional competition, we estimate property tax rate models which relate municipal tax rates to those of competing jurisdictions, school districts, and counties, using spatial econometric techniques. The spatial regression results provide strong evidence for the existence of both types of competition, showing that municipalities react negatively to the changes in county tax rates and positively to the changes in tax rates of school districts and competing municipalities.

We also examine the effects of competition among governments on government performance. More specifically, we estimate the effect of competition on the combined tax rates of municipalities and school districts, on property values, and on DEA technical efficiency scores. We find that inter-jurisdictional competition leads to lower tax rates and enhances both allocative and technical efficiency. This confirms the beneficial effect espoused by Tiebout, the Leviathan hypothesis, and yardstick competition, but not the harmful effect of the tax competition theory. We also find that school district consolidation reduces tax rates but does not have any significant effect on allocative and technical efficiency. In addition, we find that school budget referendums lower tax rates and lead to allocative efficiency.

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Chapter I. Introduction

Competition among governments can be defined as "rivalrous behavior in which each government attempts to win some scarce benefit resources" or "avoid a particular cost" (ACIR, 1991, p.xv). In a multi-tier government system, two types of competition can take place: horizontal and vertical competition. The horizontal or inter-jurisdictional competition entails competition among the same level of governments. On the other hand, vertical or intra-jurisdictional competition, involves competition between governments having different powers.

The efficiency implications of inter-jurisdictional competition have been explored in the public finance literature since Tiebout's (1956) seminal paper, "A Pure Theory of Local Expenditures." According to Tiebout, if local governments compete with each other and citizens are able to "vote with their feet," there may be fairly strong pressures for local governments to respond to the wishes of the resident. Moreover, competition among local governments would create pressures to increase productivity and reduce waste in order to avoid becoming uncompetitive relative to other local governments. While Tiebout's paper was a purely theoretical piece, it has had wide theoretical and empirical applications.

Depending on the assumed channel of competition, on the developmental history, and on the assumption of government behavior, the existing studies on inter-jurisdictional competition can be further grouped into three broad categories: tax competition, Leviathan hypothesis, and yardstick competition. The three models have different views on the mechanisms in which competition arises and the effect of competition on government performance. The Leviathan hypothesis and tax competition models are based on the mobility of residents, capital, or factors of production, while yardstick competition arises through the fact that citizen-voters comparatively evaluate the performance of politicians in an election. In terms of effects of competition, all models have in common a prediction that competition reduces tax rates and the provision of public services, but they seem to interpret differently the reduced tax rates and public services. While the Leviathan hypothesis and yardstick competition view the reduced tax rates and public services as the elimination of waste, tax competition regards it as the loss of welfare.

More recently, attention has turned to intra-jurisdictional competition arising from tax base sharing and overlapping services between different levels of government. The intra-jurisdictional competition literature analyzes the equilibrium tax levels and the reaction of the lower level of government to the policy changes of the higher level of government. Most equilibrium analyses have in common the result that an increase in taxes by one level of government results in a reduction in revenue to the other level and this negative externality leads to excessive taxation compared with coordinated or unitary government policies. The intra-jurisdictional competition literature also theoretically investigates the reaction of one level of government to a change in the fiscal policy of the other level of government. However, no clear-cut sign of a reaction arises from a theoretical analysis. It is an empirical matter to determine the sign of reaction.

The main purpose of this study is to assess the existence of competition among local governments and its effect on government performance. As theoretical and empirical studies suggest, both inter- and intra-jurisdictional competition take place simultaneously, although different branches of literature have often tended to emphasize one or the other of these forms of competition. This study incorporates various theories on competition among governments into a comprehensive framework. Specifically, the following questions are addressed in this study: 1) Do local governments compete with each other? 2) Does competition among governments increase or decrease tax rates? 3) Does competition among governments enhance the allocative efficiency of local governments? 4) Does competition among governments enhance the technical efficiency of local governments?

To examine the above questions, several equations are estimated by using a data set of local governments in New Jersey from 2001 to 2004. First, to examine the existence of both inter- and intra-jurisdictional competition, this study estimates spatial tax rate setting models, which relate the tax rate of a given municipality to those in competing municipalities, in school districts, in counties, and other determinants of tax rates, using spatial econometric techniques. Second, to examine the effects of competition on government performance, this study estimates three government performance regression models, which link government performance to the measures of inter- and intra-jurisdictional competition and to other determinants of government performance. Government performance is defined as the combined municipal-school district property tax rates, property values, and DEA technical efficiency scores.

This study extends the existing literature on fiscal competition among governments by examining the following ignored or less understood issues: 1) the effect of competition both on allocative efficiency and on technical efficiency and 2) the presence of tax competition between municipalities and school districts. This study also contributes to understanding the competition among governments by simultaneously exploring 1) the presence of inter- and intra-jurisdictional competition at the local municipal level and 2) the presence and the effect of inter- and intra-jurisdictional competition using the same data. In addition, by examining the effects of local government consolidation on allocative and technical efficiency, this study can suggest an answer to the ongoing debates on the consolidation of local governments in New Jersey.

This study consists of six chapters, including the introduction. Chapter II provides a background for this study by reviewing the theoretical and empirical literature on competition among governments. For each theory of inter- and intra-jurisdictional competition, the mechanisms in which governments compete and the effect of such competition on government performance is reviewed. Then, empirical evidence in support of each theoretical claim is provided. At the end of the chapter, a summary of theoretical arguments and empirical findings are provided and theoretical issues to be further examined and methodological issues of empirical studies are suggested.

Chapter III presents a broad overview of how New Jersey local governments are organized, what services they provide, and how they are financed. The first section examines the governmental structure for providing local public goods and services. The types of local governments, functions and decision-making frameworks of each type of local government are examined. The second section outlines the budget process of local governments in New Jersey and analyzes what services local governments provide and how they are financed. The third section is devoted to property tax administration because of its importance in financing local public goods and services.

Chapter IV derives hypotheses to be examined and develops empirical models examining the hypotheses. The first section derives hypotheses from the theoretical and empirical research on inter- and intra-jurisdictional competition. The second section defines four different public markets in which local governments are assumed to compete with each other. The third section specifies two types of empirical models to test the hypotheses. In specifying each empirical model, dependent and independent variables are identified and defined, and their empirical measurements are provided. The final section presents the data sources to be used for estimating the empirical models along with descriptive statistics of the variables.

Chapter V presents the results of the empirical analyses. The first section provides the results of spatial regression analyses examining the existence of both inter- and intra-jurisdictional competition. The remaining section reports the results of cross-sectional or panel regressions, which are intended to examine the effect of inter- and intra-jurisdictional competition in terms of the combined municipal-school district tax rate, allocative efficiency, and technical efficiency. Chapter VI concludes with a review of the main findings, limitations, and recommendations for future research directions.

Chapter II. Alternative Theories of Fiscal Competition among Governments

This chapter provides the background for this study by reviewing the theoretical and empirical literature on competition among governments. Competition among governments can be defined as "rivalrous behavior in which each government attempts to win some scarce benefit resources" or "avoid a particular cost" (ACIR, 1991, p.xv). Kincaid (1991), among others, provides the typology of competition among governments in a federal system: horizontal and vertical competition. The horizontal competition, which is also called inter-jurisdictional competition, entails competition among the same level of governments having compatible powers but different geographic jurisdictions, such as competition among states, competition among counties, and competition among municipalities.

On the other hand, vertical competition, which is also called intergovernmental competition, involves competition between governments having different powers, such as competition between the federal government and the states, between a state and its local governments, and a county and its local governments (Kincaid, 1991). In addition to the hierarchical case, competition can take place among political jurisdictions that have co-equal powers and share the same jurisdiction, such as competition between a municipality and a special district. Instead of vertical or intergovernmental competition, intra-jurisdictional competition is used in describing competition among different types of governments having co-equal powers. However, in hierarchical cases, these three terms, inter-jurisdictional, vertical, and intergovernmental competition, are used interchangeably throughout this study.

Governments compete for scare resources through various policy tools. Inter-jurisdictional competition may take place via tax, regulation, welfare, expenditure, and other government policy initiative. Intra-jurisdictional competition can take place for two main reasons: co-occupancy of a tax base on the revenue side of the budget and overlapping service provisions on the spending side of the budget (ACIR, 1991). The literature has also examined competition among governments based on the use of various government policies, from both a theoretical and empirical framework. However, for the purposes of this study, the literature review is constrained so as to focus on studies examining competition in tax policies among local governments. [1]

Depending on the assumed channel of competition, on the developmental history, and on the assumption of government behavior, the existing studies on inter-jurisdictional competition can be grouped into four broad categories: Tiebout (1956), tax competition, Leviathan hypothesis, and yardstick competition. For each theory, including intra-jurisdictional competition, the mechanism in which governments compete and the effect of such competition on government performance are reviewed. Then, empirical evidence in support of each theoretical claim is provided. At the end of this chapter, a summary of theoretical arguments and empirical findings is provided and theoretical issues to be further examined and methodological issues of empirical studies are suggested.

1. For theoretical analyses, see Saavedra (2000) and Wilson (2005) for welfare competition and Wilson and Gordon (2003) for expenditure competition. For empirical studies, see Brueckner (1998) for growth control policies in California cities, Fredriksson and Millimet (2002) for environmental policies in U.S. states, Revelli (2003) for expenditures in UK local governments, and Solé-Ollé (2006) for expenditure spillover in Spanish local governments.

2-1. Tiebout – The Origin of Inter-jurisdictional Competition Theory

One of the most important and influential models of competition among governments is the Tiebout model.[2] In Tiebout's (1956) seminal paper, "A Pure Theory of Local Government Expenditures," he proposes that citizen mobility combined with competition among governments leads to market-like efficiency in the provision of local public services. A large body of literature, including tax competition and the Leviathan hypothesis, has addressed the theoretical and empirical questions raised by Tiebout (1956).

Tiebout's paper was written as a response to Samuelson's (1954) argument that the market cannot correctly identify demand for collective goods and the absence of a market mechanism for public goods results in an inefficient allocation compared to the market for private goods (Mieszkowski and Zodorow, 1989). Tiebout constructed a model in which numerous local governments provided different public services and tax packages, thus offering potential residents a wide variety of fiscal choices. Local public services were financed by head taxes and had no benefit-spillover across jurisdictions. Residents were assumed to be costlessly mobile and to have perfect information about tax and expenditure policies.

Tiebout argued that under such circumstances residents would reveal their preferences for local public goods through their choice of their residential community, and that the resulting level of local public service provision would be efficient. This result of efficient provision of local public services is based on such unrealistic assumptions as identical preferences of citizens, no externality of public services, costless mobility of

2. According to Dowding, John, and Biggs (1994), over 1,000 articles and books have cited Tiebout (1956) since 1970.

citizens, perfect information about taxes and expenditures, and exclusively relying on head taxes to finance expenditures.

A large body of literature has been devoted to assessing the validity of Tiebout's contention by generalizing Tiebout's model and testing it empirically.[3] Different tests concentrate on different implications and assumptions of the Tiebout model. These include the capitalization studies, migration studies, tax competition, and Leviathan hypothesis, among others. Capitalization studies have focused on the extent to which property taxes and local government expenditures are capitalized into house values. Migration studies have examined the links between the residents' mobility and the local government tax and expenditure policies.

Tiebout's primary concern was not to analyze the effects of inter-jurisdictional competition but to find a market-like mechanism that would achieve an efficient allocation of resources in the local public sector. However, competition among local governments was a key component of the Tiebout model. The Tibout model's efficiency implication of competition among governments has been extended and elaborated by the tax competition and the Leviathan literatures, which are reviewed in the following section, respectively.

2-2. Tax Competition

Since the mid 1980s, one line of public finance literature has focused on the fiscal competition among local governments induced by the mobility of the tax base, which generates what is known as tax competition. The basic argument of tax competition

3. For a review of theoretical extensions and empirical tests of the Tiebout model, see Mieszkowski and Zodorow (1989) and Dowding, John, and Biggs (1994).

originally raised by Oates (1972) is that attempts by local governments to attract business investment may lead to inefficiently low levels of local public goods, which is usually termed 'under-provision' of public goods or 'allocative inefficiency' in the tax competition literature.

The Oates's (1972) intuitive reasoning was first formalized by Zodrow and Mieszkowski (1986) and Wilson (1986) and many subsequent formal theoretical studies have extended those initial tax competition models by allowing more realistic assumptions. While the formal theoretical analyses have focused on the potential allocative efficiency problems associated with competition for mobile capital by local governments, empirical studies have exclusively explored the existence of tax competition with few exceptions.

2-3-1. Theoretical Analysis

Oates (1972) counters Tiebout's (1956) optimistic view on competition among local governments, suggesting that competition for mobile capital among local governments may lead to suboptimal provision of public goods. A sizable formal theoretical literature analyzes Oates's (1972) intuitive prediction, investigating equilibrium tax rates and expenditure levels in a non-cooperative Nash game framework, where tax rates are the strategic variable.

The common features of all formal theoretical models are as follows: Each local government simultaneously sets its tax rate and expenditure levels to maximize the welfare of residents within its jurisdictions, given the tax rates chosen by all other jurisdictions. Each local government is concerned that higher tax rates will drive out capital and decrease its tax revenues. Therefore, each government attempts to increase the capital investment and tax revenues in its jurisdiction by lowering its tax rate. Because a higher tax rate drives away capital, reducing the local tax base, governments are reluctant to levy high taxes.

The initial tax competition models stick to the situation that Oates (1972) envisioned. Therefore, in contrast to the Tiebout's (1956) model, the initial tax competition model assumes that residents are immobile and their preferences are identical across jurisdictions. In addition, instead of relying on non-distortionary head taxes, local governments finance the provision of public goods with a tax on mobile capital, which is fixed in total supply. Subsequent formal theoretical models extend the initial model by allowing mobility of residents, heterogeneous demand for public goods, and multiple tax instruments.

A. Origin of Tax Competition

Tax competition models have their roots in Tiebout (1956). The Tiebout competition model posits that the equilibrium level of public goods will be efficient in a local jurisdiction due to citizen mobility. This theoretical prediction did not receive much attention until Oates's (1969) empirical study of property tax capitalization, which intended to examine one proposition of Tiebout's (1956) competition model that local public service will tend toward efficient provision. In his study, Oates (1969) seems to suggest a positive influence of local public expenditures and a negative effect of property taxes on property values as evidence for the Tiebout's proposition. The Oates's study (1969) has spawned a large number of empirical studies, which is known as the capitalization literature.

On the other hand, Oates (1972) counters Tiebout's (1956) argument by indicating the possible bad side of competition among governments. First, Oates (1972, p.140) suggests the possibility of competition among local governments without citizen mobility such that "even where individuals are wholly immobile among jurisdictions, a high degree of mobility of capital can itself lead to serious problem for decentralization." Then, Oates (1972, p.142) describes the tax competition among local governments for mobile capital in more detail such that, "Local officials, in an attempt to attract new investment to stimulate local employment and income, compete with neighboring jurisdictions by holding down local tax rates."

Finally, Oates (1972, p.143) describes the possible harmful effects of the tax competition as follows:

> "The result of tax competition may well be a tendency toward less than efficient levels of output of local services. In an attempt to keep taxes low to attract business investment, local officials may hold spending below those levels for which marginal benefits equal marginal costs, particularly for those programs that do not offer direct benefits to local business."

In addition, he also recognizes potential disadvantages from fiscal decentralization, which can produce competition among governments, in other aspects. He argues that, by reducing jurisdiction sizes, decentralization could require a sacrifice of economies of scale in the production of public goods.

A number of formal theoretical studies have examined and, in general, confirmed Oates's (1972) intuitive conclusions about harmful effects of competition among local governments for mobile capital. Based on assumptions that yield different implications about local government fiscal behavior, these formal tax competition models can be grouped into three categories: a purely competitive tax competition model, a strategic tax competition model, and an asymmetric tax competition model. While the strategic model assumes that, to set its optimal tax rate, governments in each jurisdiction take into account tax rates in other jurisdiction, this strategic competition among governments is absent in the purely competitive model. The asymmetric tax competition models extend the competitive and strategic competition models by allowing difference in population size or heterogeneous preferences of residents between jurisdictions.

B. Purely Competitive Tax Competition Models

Zodrow and Mieszkowski (1986) and Wilson (1986) first offer theoretical models that examine the intuitive idea of tax competition described by Oates (1972). These initial studies analyze tax competition within a purely competitive framework in which there are a large number of jurisdictions and each jurisdiction is small relative to the national economy. Due to its small size, any jurisdiction cannot affect the national net tax return to capital. Consequently, any single jurisdiction's policy has no direct effect on policies in any other jurisdictions and all other jurisdictions do not respond to changes in that jurisdiction's policy.

Zodrow and Mieszkowski (1986) build a model consisting of a large number of identical jurisdictions. Each jurisdiction has two factors of production, mobile capital whose stock is fixed nationally and an immobile factor which may be thought of as land or labor. Each jurisdiction has the same number of identical residents. Governments in each jurisdiction finance public goods with a tax on the mobile capital. The public goods are consumed by the residents. Each government sets its tax and expenditure levels to maximize the welfare of a representative resident. In doing so, each government perceives that a rise in the tax rate creates disincentives for capital investment within the region. They demonstrate that the existence of these disincentives causes governments to set inefficiently low rates of taxes on the capital. As a result, the public goods are underprovided.

An alternative approach to Zodrow and Mieszkowski (1986) is taken by Wilson (1986), who also shows a similar result. Wilson models an economy with many small identical jurisdictions. Each jurisdiction has two primary factors of production, mobile capital and immobile land. Expenditures on public goods are financed by a property tax on the mobile capital. Wilson demonstrates that tax competition results in the undersupply of public goods through an analysis of capital to labor ratios within each jurisdiction. In particular, Wilson finds that firms substitute labor for capital when the mobile capital is taxed to finance the public goods. In addition, Wilson characterizes tax competition as a form of fiscal externality.

Zodrow and Mieszkowski (1986) and Wilson (1986) prove that public goods are underprovided if a number of jurisdictions compete for mobile capital and are required to finance expenditures by a property tax on this mobile capital. Both Zodrow and Mieszkowski (1986) and Wilson (1986) also demonstrate that if a head tax is allowed, governments will use only the head tax and provide public goods up to the optimal level. Zodrow and Mieszkowski's (1986) model became the benchmark model of tax competition due to its algebraically simple characteristics and simple production structure compared to Wilson's (1986) model. Zodrow and Mieszkowski's (1986) work has spawned numerous theoretical studies exploring the effects of relaxing the assumptions of their tax competition model.

C. Strategic Tax Competition Models

The theoretical models of Zodrow and Mieszkowski (1986) and Wilson (1986) deal with the purely competitive case where the number of jurisdictions engaging in tax competition is large. More recently, some studies have explored the tax competition in a limited number framework where strategic interactions are possible. In this strategic competition framework, there are a small number of jurisdictions, which are large relative to the economy and are able to affect the net of tax return by changing their tax rates. Therefore, to choose their optimal tax rates, jurisdictions take into account inter-jurisdictional capital outflow and their effects on the net return to capital.

Wildasin (1988) first analyzes tax competition among a small number of regions, especially two regions. In particular, to examine and compare strategic competition in the tax rate and that in the expenditure level, Wildasin constructs a two-stage model, in which regions choose their strategic variables in the first stage and, then, choose the levels of the chosen variables in the second stage. In the model, each region assumes that if it changes its tax rate (expenditure) the other region will maintain balanced budgets by keeping taxes (expenditure) constant and adjusting expenditures (taxes). In both tax and expenditure competition cases, Wildasin confirms the results of standard tax competition that competition leads to inefficiently low tax rates and thus under-provision of public goods. In addition, Wildasin demonstrates that tax and expenditure levels are lower in the expenditure competition case than in the tax competition case.

Hoyt (1991) explores tax competition within the strategic competition framework, in which policies in a jurisdiction are assumed to result in responses from other jurisdictions. In particular, he examines how tax rates and public service levels change as the number of jurisdictions engaging in competition expands. He follows Wildasin (1988) in that it is assumed that other jurisdictions respond to changes in a jurisdiction's tax rate by altering public service levels but not their tax rates. Like most other studies, he shows that inter-jurisdictional competition in tax rates leads to inefficiently low tax rates and thus under-provision of public services. Furthermore, he demonstrates that an increase in the number of jurisdictions leads to greater under-provision of public goods and therefore to lower welfare of residents in all jurisdictions. He suggests the consolidation of jurisdictions as the solution to the inefficiency caused by tax competition.

Bucovetsky and Wilson (1991) analyze tax competition with multiple tax instruments in a strategic tax competition framework. In their model, in addition to a source-based capital tax, governments have access to either a residence-based capital tax or a tax on wage income to finance public goods. Except for the presence of multiple tax instruments and the small number of jurisdictions, all other features of their model are identical to that of Zodrow and Mieszkowski (1986). They find that, while competition between jurisdictions for scarce capital leads to inefficiently low levels of public goods provision in the absence of the residence-based capital tax, governments choose the efficient level of public good provision in the absence of the tax on wage income. Thus, they conclude that not the presence of the source-based capital tax, but the absence of the residence-based capital tax is responsible for the under-provision of public goods.

D. Asymmetric Tax Competition Models

The reviewed tax competition models to this point focus on the case where all jurisdictions are identical and therefore choose the same tax rates. In these symmetric tax competition models, the cost of a capital outflow from one region is exactly offset by the benefits from the accompanying capital inflows to other jurisdictions (Wilson, 1999). Some studies explore tax competition with asymmetry among jurisdictions. Two previously studied sources of asymmetry are size of jurisdiction in terms of population (Bucovetsky, 1991; Wilson, 1991) and preferences of residents (Brueckner, 2000).

Bucovetsky (1991) considers a tax competition between two regions with different numbers of identical residents and thus different total endowments of labor and capital. His model is similar to that of Wildasin (1988) in most respects. Bucovetsky's main finding is that the residents of the smaller region are better off than residents of the larger region. This result is due to the difference in elasticity of supply with respect to capital between the two regions. Because the larger region is the relatively larger demander in the capital market, the supply of capital to the larger region is less responsive to tax rate changes. Consequently, the larger region is less motivated to cut tax rates to attract additional capital and therefore ends up with the higher tax rate. This tax rate differential between the two regions generates a capital flow from the larger region to the smaller region, enabling residents of the smaller region to consume more public goods than those in the larger region.

Wilson (1991) generalizes Bucovetsky's (1991) result using the strategic tax competition model with multiple tax instruments. First, Wilson examines the asymmetric tax competition under the standard tax competition assumptions and confirms the results of Bucovetsky's (1991) analysis that the smaller region is better off than the larger region. Further, Wilson explores whether the strategic advantages of the smaller region under the standard tax competition framework carries over to the case where both a capital tax and a labor tax are available to governments for financing public service provision. In this case, two regions compete in capital tax rates to attract mobile capitals, but each region alters the labor tax rate rather than expenditure levels to respond to the other's capital tax rate changes. Under the tax competition model with multiple tax instruments, Wilson again demonstrates that the smaller region has the strategic advantage.

Brueckner (2000) blends Tiebout's (1956) model and the tax competition model by introducing heterogeneous preferences between jurisdictions and mobile residents into a tax competition framework. Then, he compares the welfare of different consumer types in terms of public service demand between capital tax and head tax cases. In the model, a large number of competitive "developers" choose public good levels and tax rates on mobile capital to maximize the profits from providing the public goods, and mobile residents sort themselves across communities according to their preferences. In the equilibrium, high (low) service demanders locate in communities with high (low) public good levels and low (high) wages, implying low (high) consumption of the private good. He shows that the capital tax continues to create a positive externality, resulting in inefficiently low tax rates and public good levels. Furthermore, he demonstrates that, under the capital tax, high demand communities are worse off and low demand communities may be better off than under the head tax.

E. Summary of Theoretical Analysis

A perennial question in the tax competition literature is whether tax competition results in under-provision of public goods, i.e. tax rates and expenditure levels that are lower than the optimal level. In general, but not always, the formal theoretical analyses have confirmed Oates's (1972) intuitive conclusions about the tax competition among local governments. The main results of the formal theoretical analyses can be summarized as follows: Because a higher tax rate drives away capital, reducing the tax base, governments are reluctant to levy high taxes and this reluctance leads to under-provision of public goods or allocative inefficiency.

Some studies, including Wilson's (1986, 1995) and Wildasin's (1989), explain the tax competition in terms of a fiscal externality created by tax rate differentials across regions. A cut in the tax rate of a region causes a capital inflow from other regions that decreases their tax base and thus their tax revenues. But, the government in the region creating this externality ignores it when setting its tax and expenditure levels because it is concerned with only the welfare of its own residents. Consequently, it sets its tax rates and public good levels at inefficiently low levels. A tax rate-induced capital outflow is a cost from the single region's viewpoint, but not from the entire economy's view point because the economy's total capital stock is assumed to be fixed in the tax competition model.

In addition to the allocative efficiency issue, several other results from the formal theoretical analysis are noteworthy. When multiple tax instruments are available, Bucovetsky and Wilson (1991) show that the existence of source-based taxes on mobile capital income does not necessarily imply under-provision of public goods if other taxes are available, and that the absence of the residence-based tax is responsible for the under-provision of public goods. When jurisdictions differ in population size, Bucovetsky (1991) and Wilson (1991) show that the smaller jurisdiction levies a lower tax rate and its residents are better off than residents of the larger jurisdiction. When residents' preferences are heterogeneous between jurisdictions, Brueckner (2000) demonstrates that while public goods are under-provided in high demand jurisdictions, public goods may be under- or over-provided in low demand jurisdictions.

Oates (1972) and subsequent formal theoretical studies yield several theoretical predictions that can be empirically testable, give insights into understanding the fiscal behavior of local governments, and provide policy recommendations. Tax competition theory provides two main predictions about how the presence of tax competition can be detected. First, the tax rate in a jurisdiction is influenced by the tax rates in neighboring or competing jurisdictions. The strategic tax competition model posits that, in setting its tax rate, government in each jurisdiction considers tax rates of other jurisdictions. This strategic behavior of each governments leads to interdependency in tax rates among jurisdictions. Second, the tax competition theory provides predictions that can help in discriminating tax competition from alternative theoretical explanation of competition. Tax competition theory implies that one's own tax rate has a negative impact on the tax base, while neighbors' tax rates have a positive impact on it.

The following two theoretical predictions are related to the consequences of tax competition. First, asymmetric tax competition models yield a proposition that market share of a jurisdiction in terms of population is inversely related to its tax rate and allocative efficiency. Bucovetsky (1991) and Wilson (1991) demonstrate that relatively small regions have a competitive advantage in tax competition, showing that larger jurisdictions are found to set higher taxes in equilibrium, but smaller jurisdictions are found to enjoy higher welfare. Second, Hoyt (1991) provides a prediction that an increase in the number of jurisdiction engaging in tax competition leads to greater under-provision of public goods. With a strategic competition framework, Hoyt demonstrates the proposition and suggests consolidation as a solution to this allocative inefficiency caused by competition for mobile capital.

2-3-2. Empirical Evidence of Tax Competition

Normative and theoretical literatures on tax competition bring two fundamental issues, whether or not governments engage in tax competition and what are the consequences of tax competition. Most empirical studies on tax competition have focused on examining the presence of tax competition by using spatial econometric techniques. These studies can be classified into two strands. One strand has focused on only the tax competition among the same level of governments. The other strand allows intra-jurisdictional interaction between different levels of government in their models.

On the other hand, only a few studies have examined the effect of tax competition on the allocative efficiency, which is the main theme of theoretical analyses. Based on Breuckner's (1979, 1982) theoretical theses and empirical demonstrations by subsequent studies including his own, these empirical studies regress property values, which are assumed to measure allocative efficiency, on measures for the degree of competition and property value determinants.[4] The empirical study on tax competition is summarized in Table 2-1.

A. Inter-jurisdictional Competition

To examine the existence of tax competition, empirical studies estimate a reaction function, which relates each government's tax rate to its own characteristics and to its

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4. Brueckner's model for the evaluation of allocative efficiency is explained more in detail in Chapter V, Research Design.

competitors' tax rates.[5] The presence of tax competition is tested by examining the significance of the slope coefficient of the reaction function, which estimates the effect of the average tax rates of competitors on a given government's tax rate.[6] Because the direction of the effect of competitors' tax rate is theoretically ambiguous (Bruckner, 2003), the significant slope coefficient is suggested as evidence for the presence of tax competition.

Based on a data set of 248 large U.S. counties in 1978 and 1985,[7] Ladd (1992) examines inter-jurisdictional competition in total taxes, property taxes, residential property taxes, general sales taxes, and other taxes. All tax variables are aggregated for all local governments in a county and are deflated by personal income. Neighbors are defined as non-central counties in the same SMSA. The regression results confirm the existence of competition for total taxes, property taxes, and residential property taxes. The coefficients on neighbors' average total taxes and property taxes in both 1978 and 1985 and the coefficient on neighbors' average residential property taxes in 1978 is positive and significant. The results are consistent with the tax competition theory.

Brueckner and Saavedra (2001) investigate property tax competition among local governments, based on data of 70 cities in the Boston metropolitan area in 1980 and 1990. They estimate property tax reaction functions under four different average tax rates of competitors: simple and population-weighted average tax rates of competitors, which are defined by contiguity and distance decay. Their research findings suggest evidence of

5. Neighbors, competitors, and rivals are used interchangeably in the literature dealing with the inter-jurisdictional competition and spatial econometrics.
6. In the spatial econometrics, the slope coefficient is usually called the spatial lag coefficient and the average tax rate of competitors is called the spatially lagged dependent variable. See Chapter IV and V for discussion pertaining to spatial econometrics.
7. In the regression analyses, only 94 counties are used.

competition among cities in setting property tax rates. The slope coefficient is positive and statistically significant under all four average tax rates of competitors in 1980. However, regression results in 1990 are somewhat mixed. While the slope coefficients are positive and statistically significant in the business tax rate, they are not significant in the total tax rate.

Using data on 296 UK non-metropolitan districts, Revelli (2002b) investigates competition in both expenditure levels and property tax rates and discriminates between alterative sources of competition in expenditure levels, benefit spillovers and tax competition. He defines competitors based on contiguity criterion. His regression results show that spatial lag coefficients are positive and significant in both expenditure level and property tax rate equations. However, further analysis shows that the positive and significant spatial lag coefficient in the expenditure level equation is caused by spatial autocorrelation in the error term. Based on the above results, he concludes that districts engage in property tax competition and this, in turn, causes the observed spatial interaction in the expenditure levels.

Unlike most other studies, Buettner (2003) directly examines the tax competition and discriminates it from other sources of competition. He estimates business tax base reaction functions, which relate a given government's tax base to its own and competitors' tax rates and to other control variables, using a panel of 966 German municipalities. The results show the negative effect of the own tax rate on the tax base. However, the average tax rate of competitors has a positive and significant effect on the tax base only when it is interacted with the relative population size of competitors in the public market, which is defined by distance. He suggests the above results as evidence confirming the asymmetric tax competition theory (Bucovetsky, 1991; Wilson, 1991) that smaller jurisdictions are more sensitive to the changes in competitors' tax rates.

Hernández-Murillo (2003) examines competition in capital income tax rates, using a panel data set of 48 U.S. states and the District of Columbia for the period of 1977-1999. He defines rival states based on contiguity and Crone's (1998/1999) region, and the average tax rates of competitors are weighted by population, geographic distance, and Mahalanobis (1930) distance.[8] Under all cases of spatially lagged dependent variables, he confirms the presence of the tax competition, showing that the slope coefficient is positive and statistically significant.

Egger, Pfsffermayr, and Winner (2005) investigate tax competition in four excise taxes: gasoline, cigarettes, beer, and wine taxes. Using a panel data set of U.S. states over the time period 1975-1999, they estimate each reaction function for the four taxes by both random-effects and fixed effects estimation methods. In the reaction functions, competitors are assigned to a given state based on contiguity criterion. They find a positive and statistically significant slope coefficient of the reaction function for each tax, which confirms the presence of tax competition.

B. Inter-and Intra-jurisdictional Competition

As intra-jurisdictional competition theory suggests, in a multilevel governmental structure, fiscal competition can occur between different types of government and between different levels of government when they share the same tax base. Some recent studies on tax competition allow this intra-jurisdictional competition in their model, although their main purpose is to examine the inter-jurisdictional competition in tax

8. The Mahalanobis distance is calculated using population density, average temperature, and personal income.

policy decision-makings. In the empirical specification, the effect of intra-jurisdictional competition is controlled for by including the tax rate of the higher level of government.

Brett and Pinkse (2000) examine the presence of competition and the reciprocal effect between the tax rate and the tax base in business property taxes. Using panel data of 142 municipalities for British Columbia in 1987 and 1991, they estimate structural equations, which also allow the interaction between municipal and non-municipal tax rates. The results show that coefficients on the tax rates of competitors, which are defined by road, are positive and significant in the tax rate equation, but both coefficients on own and competitors' tax rates are statistically insignificant in the tax base equation. Thus, their results provide evidence for the presence of competition in a business tax rate setting, but, unlike Buettner (2003), can not confirm that it is caused by the tax competition. Their results also provide some evidence for intra-jurisdictional interaction, showing that the coefficient on the non-municipal tax rate is negative and significant in the random-effects but not in fixed effects estimations.

Luna (2004) examines sales tax competition for 95 counties in Tennessee for the period of 1977-1993. She estimates both the tax rate and the tax base reaction functions. Competitors are defined as border sharing counties and the average tax rates and tax bases of competitors are weighted by population. The results show that the own tax rate has a negative affect on the tax base and competitors' tax rates positively affect it, and that competitors' tax rates have a positive effect on the tax rate. The results are consistent with sales tax competition theories of Mintz and Tulkense (1986) and Kanbur and Keen (1993). Her findings also provide evidence for intra-jurisdictional interaction between counties and the state in setting sales tax rates, showing the positive and significant coefficient on the state sales tax rate.

To examine both horizontal competition and vertical interaction, Hendrick, Wu, and Jacob (2007) estimate property and sales tax reaction functions for 238 municipalities in the Chicago metropolitan area from 1998 to 2000. In their model, competitors are assigned to each municipality based on contiguity and distance. Their results provide evidence supporting the presence of competition among municipalities in setting the property tax rate, showing that the coefficients on the competitors' tax rates are positive and significant in the property tax equation. However, their results show that the coefficients on the competitors' tax rates are not statistically significant in the sales tax equation, indicating the absence of competition in the sales tax. Their results also provide a little evidence of vertical interaction between municipalities and counties, showing that the coefficient on county tax rates is statistically significant in the property tax equation with the distance based competitors' tax rates.

C. Effect on Allocative Efficiency

There are two contrasting views on inter-jurisdictional competition in terms of allocative efficiency. While Tiebout (1956) and yardstick competition suggest that inter-jurisdictional competition induced by "vote with one's feet" results in the efficient allocation and production of public goods, the traditional tax competition literature argues that inter-jurisdictional competition for mobile factors leads to under-provision of public goods and, thus, to allocative inefficiency. Given such competing perspectives on the effect of inter-jurisdictional competition, the implication of competition in terms of allocative efficiency becomes an empirical question. Deller (1990) and Bates and

Santerre (2006) have examined the effect of inter-jurisdictional competition on allocative efficiency in local governments using Brueckner's (1979, 1982) results that property values are maximized when public goods are provided efficiently.

Deller (1990) explores whether the provision of local public goods is allocatively efficient and whether inter-jurisdictional competition leads to allocative efficiency in the local public sector. Using a data set of 96 counties in Illinois, he regresses aggregate property values on the number of governments per 1000 capita within a county, expenditures on education, transportation, and police, and other control variables, which are specified in Brueckner's model (1979, 1982). The results show that coefficients on police and transportation are significant and positive, and the coefficient on education is insignificant. He suggests this as evidence that police and transportation services are under-provided and education is neither over- nor under-provided. He also suggests that inter-jurisdictional competition improves the allocation of public goods in the local public sector by showing that the number of governments positively affects property values.

Recently, Bates and Santerre (2006) examine the impact of the degree of inter-jurisdictional competition on allocative efficiency, based on 169 towns and cities in Connecticut. As in Deller's (1990) study, they use aggregate property values in each municipality as the measure of allocative efficiency. The public market for municipalities is defined as the SMSA for urban towns and cities and the county for rural communities. The degree of competition is measured by market share and Herfindahl-Hirschman Index (HHI) of market concentration. The regression results show that the market share is positively related to the aggregate property values, indicating that larger market shares may enjoy some economies. The results also show that the HHI has a negative effect on the aggregate property values. They suggest this result as the evidence supporting the hypothesis that competition among local governments improves resource allocation in the local government.

D. Summary of Empirical Studies

Most empirical studies examine whether or not local governments engage in tax competition using property taxes. While there has been a debate on whether the property tax can be regarded as the capital tax analyzed in the theoretical tax competition literature, the property tax is the most similar real tax to the capital tax (Brueckner and Saavedra, 2001; Brueckner, 2004). The empirical studies estimate the spatial dependency in tax rates among local governments by employing spatial econometric techniques. Most studies provide evidence for the presence of tax competition, showing that neighbors' or competitors' tax rates significantly affect the tax rate of a given government.

Some studies try to discriminate tax competition from alternative competition theories, especially yardstick competition. For example, Buettner (2003) and Brett and Pinkse (2000) estimate the tax base reaction function and the structural equation of tax rate and tax base, respectively. Buettner confirms that the observed spatial interaction is caused by tax competition, finding a negative effect of own tax rate and a positive effect of neighbors' tax rates on the business tax base. On the other hand, Brett and Pinkse find no statistically significant effect of both own and competitors' tax rates on the tax base, which cannot confirm that the spatial dependency in tax rate is attributed to tax competition.

Some recent empirical studies examine the presence of tax competition, controlling for intra-jurisdictional competition between different levels of government. While Brett and Pinkse (2000) and Luna (2004) provide evidence for the presence of both inter- and intra-jurisdictional competition, Hendrick et al. (2007) find that only inter-jurisdictional competition is statistically significant. Compared to studies ignoring intra-jurisdictional competition, this line of studies is superior in examining the magnitude and the statistical significance of tax competition because the omission of the intra-jurisdictional competition may lead to biased results when it is actually present.

Compared to a large number of studies on the presence of tax competition, only two studies have investigated the allocative efficiency implication of tax competition (Deller, 1990; Santerre and Bates, 2006). While Deller (1990) examines the allocative efficiency in the public sector by aggregating data up to the county level, Santerre and Bates (2006) explore the allocative efficiency in individual government levels. Both studies show that inter-jurisdictional competition leads to allocative efficiency. This can be interpreted as rejecting the harmful effect of tax competition and supporting the beneficial view of Tiebout (1956) on inter-jurisdictional competition.

There are a number of empirical studies examining the theoretical predictions of tax competition. While some propositions have been extensively examined, other theoretical predictions need to be further empirically examined. First, it is needed to discriminate tax competition from other possible explanations of fiscal interaction among governments. Although many studies suggest the significant spatial interdependency in tax rates as evidence of tax competition, the significant spatial pattern of tax rates can be explained by yardstick competition. As shown by Brett and Pinkse (2000), the observed spatial interdependency may not be attributed to tax competition theory.

Second, as shown above, empirical studies have exclusively focused on the presence of tax competition, while the consequence of tax competition, which is the main issue of the tax competition theory, is rarely investigated. This may reflect the lack of data and the difficulty in measuring allocative efficiency in the public sector. Only two studies examine the effect of degree of competition on allocative efficiency and their results reject the prediction of tax competition that tax competition leads to allocative inefficiency. However, the evidence is not sufficient to draw a definitive conclusion.

Table 2-1. Summary of Empirical Studies on Tax Competition

Study	Unit of Analysis	Method [1]	Dependent Variable	Horizontal / Vertical Interaction [2]	Findings of Interaction [3]
I. Existence of Tax Competition					
I-1. Inter-jurisdictional Competition					
Ladd (1992)	County, US (1978, 1985)	IV	Total and property tax burden Residential property tax burden Sales tax burden Other tax burden	Wy by SMSA	Positive Positive (NS in 1985) Negative (NS in 1978) Negative (NS in 1978, 1985)
Brueckner & Saavedra (2001)	City in Boston, US (1980, 1990)	ML	Property tax rate (P) Business property tax rate (B)	Wy by Contiguity Wy by Contiguity-DDW, PDW Wy by Contiguity-PW	Positive Positive (NS) Positive (NS in 1990 B)
Revelli (2002b)	District, UK (1990)	ML	Property tax rate Expenditure per capita	Wy by Contiguity	Positive No spatial lag dependence
Buettner (2003)	Municipality, Germany (1980-2000)	GMM	Business tax base	Neighbors tax rate (Distance) Neighbors tax rate (Distance-PW)	Positive Positive
Hernández-Murillo (2003)	State, US (1977-1999)	IV	Capital income tax rate	Wy by Contiguity Wy by Socio-economic similarity	Positive Positive
Egger et al (2005)	State, US (1975-1999)	GMM (FE, RE)	State excise tax rate (gasoline, cigarettes, beer, and wine)	Wy by Contiguity	Positive

(Continued)

Table 2-1. (Continued)

Study	Unit of Analysis	Method [1]	Dependent Variable	Horizontal / Vertical Interaction [2]	Findings of Interaction [3]
I-2. Inter- and Intra-jurisdictional Competition Study					
Brett & Pinkse (2000)	Municipality in BC [4], Canada (1987, 1991)	IV (RE, FE)	Business property tax base (B) Business property tax rate (R)	Wy by Road Tax rates set by other governments	Negative on B, Positive on R (NS in RE) Negative (NS in FE)
Luna (2004)	County in TN, US	OLS	County sales tax rate	Wy by Contiguity-PW State sales tax rate	Positive Positive
Hendrick et al (2007)	Municipality in Chicago Metropolitan Area, US (1998-2000)	IV, ML	Property tax rate Sales tax rate	Wy by Contiguity Wy by Distance County property tax rate County sales tax rate	Positive Positive (NS) Positive (NS except in IV-Distance) Negative (NS)

II. Effect on Allocative Efficiency

Study	Unit of Analysis	Method [1]	Dependent Variable	Measure of Competition [2]	Effect on Government Performance [3]
Deller (1990)	County in IL, US (1983)	OLS	Aggregate property value	NTP by County	Positive
Bates & Santerre (2006)	Municipality in CT, US (1998)	OLS	Aggregate property value	MSG by SMSA, County HHI by SMSA, County	Positive Positive

1. FE-Fixed effects, GMM-Generalized method of moments, IV-Instrumental variables, ML-Maximum likelihood, OLS-Ordinary least squares, and RE-Random-effects.
2. DDW-Distance decay weighted, PDW-Population/distance weighted, and PW-Population weighted, Wy-Spatially lagged dependent variable, SMSA-standard metropolitan statistical area, HHI-Herfindahl-Hirschman index of market concentration, MSG-Market share of the individual government, and NTP-Number of independent government per capita or 1000 persons.
3. NS-Not significant at the conventional confidence levels.
4. BC-British Columbia.

2-3. Leviathan Literature

Tiebout's (1956) beneficial view on the inter-jurisdictional competition for mobile residents is followed by the Leviathan literature. Tiebout's (1956) model of local public service provision and Niskanen's (1971) model of budget maximizing bureaucrats come together in Brennan and Buchanan's (1980) Leviathan hypothesis. Brennan and Buchanan (1980) suggest that inter-jurisdictional competition for a scarce mobile tax base is beneficial, limiting the taxing power of a revenue-maximizing Leviathan-type government and, thus, reducing government waste.

The subsequent formal theoretical analyses, in general, confirm the Leviathan hypothesis, showing that, at least in some degree, inter-jurisdictional competition can reduce government rent-seeking behavior. To empirically examine the Leviathan hypothesis, a large number of studies have analyzed the effect of inter-jurisdictional competition on government fiscal performance, which is usually measured by the government budget size. However, the empirical evidence is not consistently supportive of the Leviathan hypothesis.

2-2-1. Theoretical Analysis

The traditional public finance literature views government decision makers as benevolent rulers who maximize society's welfare. Niskanen (1971) develops a model of budget-maximizing bureaucracy, which is in remarkable contrast to the traditional public finance's view on governments. Following Niskanen (1971), Brennan and Buchanan (1980) model a government as a Leviathan who maximizes revenues from whatever sources of taxation. Then, they suggest a theoretical proposition that inter-jurisdictional competition induced by citizen mobility can serve as an indirect constraint on the potential fiscal exploitation of the Leviathan. This intuitive idea, the Leviathan hypothesis, has been examined in several formal theoretical studies by modeling tax competition in various Leviathan models of government, where governments are concerned in part with maximizing their budget.

A. Niskanen's Budget-maximizing Bureaucrats

In his famous seminal book, *Bureaucracy and Representative Government*, Niskanen (1971) developed the first rigorous economic model of bureaucracy, which provoked much subsequent modeling of government behavior (Mueller, 2003). The main idea of Niskanen's model of budget-maximizing bureaucracy is that bureaucrats are primarily self-interested individuals and, thus, they attempt to maximize their own utility through larger budgets. This model of budget-maximizing bureaucracy represents a public choice critique of the traditional view of public finance, which assumes that bureaucrats are benevolent maximizers of citizens' welfare and their main job is to execute policies made by politicians (Cope, 2000).

How are bureaucrats able to maximize their budget? Niskanen (1971) suggests that bureaucrats can maximize their budget by exploiting an asymmetry of information. In his model, it is assumed that, although politicians know something of citizens' demand for public services, they know little or nothing about the costs of production. Therefore, bureaucrats are able to request a large budget and expect political approval. This budget-maximizing behavior of bureaucrats results in government budgets being too large. Consequently, the bureaucrats' budget-maximizing behavior leads to bureaucratic "over-supply" of goods and services provided by government (Niskanen, 1978).

The initial Niskanen's (1971) model has been criticized and extended by other public choice theorists. Among the critiques and extensions of Niskanen's (1971) initial model, Migué and Bélanger (1974) are noteworthy. They argue that bureaucrats act to maximize their bureaus' discretionary budget, not just the total budget, which is assumed to be maximized in the initial Niskaen's (1971) model. Later, Niskanen (1991) accepted Migué and Bélanger's (1974) model as the general model and claimed that his initial model constituted a special case. Finally, Nikanen (1991, p.28) revised his initial model and argued that bureaucrats "maximize their bureau's discretionary budget, defined as the difference between the total budget and the minimum cost of producing the output expected by the political authorities."

Although Niskanen (1971) views the reform of the political environment or the polity as a critical way to restrain budget-maximizing bureaucrats, he also views competition among bureaus as helpful. In this respect, his main policy implication is to allow several bureaus to produce the same kind of public good and compete with each other. The main rationale for this policy suggestion is that competition among bureaus induces them to produce public goods in a more efficient way. Although the effects of competition among bureaus have not been well tested, Niskanen (1975) himself provided some evidence for the budget-maximizing effect of reducing competition by merging bureaus. Using a dummy variable for a merger of bureaus, he showed that the merged bureaus get larger budgets than if they had remained separate. He suggests this result as evidence for supporting his argument.

Niskanen's budget-maximizing model of bureaucracy still represents the mainstream position of American public choice theorists (Mueller, 2003). Although

Niskanen's model deals with individual bureaucrats, it has been applied to the behavior of bureau and government levels, including his own empirical study of 1975. The underlying assumption, which is usually implicit in applying Niskanen's model to organizational behavior, is that there is a close translation of the preferences and motivations of the individual bureaucrats into organizational results (Sigelman, 1986). Niskanen's model of budget-maximizing bureaucrats and his suggestion for the introduction of competition among bureaus give insights into understanding government behavior, in general, and contribute to the development of Brennan and Buchanan's (1980) Leviathan hypothesis.

B. Brennan and Buchanan's Leviathan Hypothesis

The Leviathan hypothesis of Brennan and Buchanan (1980) extends the Tiebout model by combining the inter-jurisdictional competition induced by citizen mobility with Nikanen's (1971) budget maximizing bureaucrats thesis. Brennan and Buchanan's (1980) suggestion is one of the most powerful statements of the view that inter-jurisdictional competition may serve as a useful supplement to inadequate direct constitutional constraints and imperfect political institutions to limit the power of the revenue maximizing Leviathan. The Leviathan hypothesis has also spawned a large and somewhat inconclusive empirical literature.

Following Niskanen (1971), Brennan and Buchanan (1980) reject the traditional public finance assumption that governments are benevolent welfare maximizers. Drawing by analogy on the conventional theory of monopoly in the private sector, they model a government as a monolithic Leviathan that systematically seeks to maximize tax revenues from whatever sources of taxation made available to it 'constitutionally' in its own interest but not the citizen-taxpayer's. Therefore, they come up with 'constitutional' tax rules intended to constrain the Leviathan and to induce it to serve in accordance with the wishes of the citizen-taxpayer.

How can the Leviathan be tamed and be made reflective to the interests of its electorates? Early public choice theory concentrated its attention largely on political competition with periodic elections as the primary means of constraining the natural proclivities of governments to expand. Brennan and Buchanan (1980) argue that tax limitation proposals did not emerge from the electoral process and electoral constraints have not been effective in limiting government to the level desired by the citizen-taxpayer. Instead, they suggest constraints and rules at the constitutional level and inter-jurisdical competition for fiscal resources as additional constraints to tame the Leviathan.

In discussing the means of constraining the Leviathan, Brennan and Buchanan's (1980) emphasis is on the arrangement of powers and duties among different levels of government, which allows citizen-taxpayers to choose the fiscal institutions that closely match their preferences for local public goods. They regard fiscal constraints and rules as adequate means of limiting the taxing power of the Leviathan at the higher levels of government. At the lower levels of government, they see inter-jurisdictional competition with citizen mobility as a valuable means of supplementing inadequate constitutional constraints on the Leviathan. Brennan and Buchanan (1980, p.184) argue that "Intergovernmental competition for fiscal resources and interjurisdictional mobility of persons in pursuit of "fiscal gains" can offer partial or possibly complete substitutes for explicit fiscal constraints on the taxing power."

Brennan and Buchanan (1980) argue that the decentralized and fragmented governmental structure produces greater inter-jurisdictional competition and allows citizen-taxpayers to effectively exercise "vote with their feet". The fragmentation of governmental units enhances inter-jurisdictional competition in that "the costs of organizing and enforcing collusive agreements increase disproportionately as the number of competitors increases" (p. 185). The fragmentation can limit the Leviathan such that "the potential for fiscal exploitation varies inversely with the number of competing governmental units in the inclusive territory. This element, taken alone, implies the efficacy of a large number of subordinate governmental units." (p.180).

They also suggest that the decentralization can serve as a constraint on Leviathan such that "Total government intrusion into the economy should be smaller, ceteris paribus, the greater the extent to which taxes and expenditures are decentralized ..." (p. 185). The logical reasoning is that the decentralization of revenue and expenditure assignments can create a market-like solution in which citizens' mobility induces governments to compete with each other and, therefore, limit government's excessive taxing power. Those Brennan and Buchanan's (1980) theoretical predictions have spawned numerous studies, especially empirical ones, examining the effects of decentralization and fragmentation on government budget size.

C. Formal Theoretical Analysis of the Leviathan Hypothesis

Brennan and Buchanan (1980) suggest the Leviathan hypothesis that competition among governments limits the size of government and reduces government waste, because the size of government would be excessive in the absence of this competition. This intuitive theoretical prediction has been examined in several formal theoretical analyses in which assumptions are similar to those of the tax competition model. The main focus of these formal theoretical analyses is on the efficiency implication of inter-jurisdictional competition under the Leviathan model of government.

Epple and Zelenitz (1981) investigate the extent to which competition among local governments for mobile residents ensures the efficient provision of local public goods. They model a metropolitan area with a number of identical jurisdictions. Governments finance public goods by property taxes imposed on the market value of housing in their jurisdictions by a flat rate. Housing service is provided by competitive firms in the jurisdiction. Governments compete for mobile residents, who are identical across jurisdictions. Each jurisdiction is governed by a monopolist government whose objective is to maximize governmental rent, defined as the excess of tax revenue over government expenditure. They find that, although increasing the number of jurisdictions reduces each government's ability to levy taxes in excess of expenditures, competition among jurisdictions is not sufficient to prevent individual governments from pursuing policies which are not in the interests of their residents. This is because governments compete for residents who can "vote with their feet" but not for immobile land and, therefore, can usurp some land rents for their own ends.

Edwards and Keen (1996) articulate and compare the two contrasting views of tax competition, the conventional tax competition model and the Leviathan model, by assuming that governments are neither the entirely benevolent maximizer of citizens' welfare nor the fully self-interested Leviathan.[9] In their model, many small identical countries compete for internationally mobile capital. In each jurisdiction, there is a

9. Their model is identical to Zodrow and Mieszkowski's (1986) standard tax competition model, with the critical difference that policy-makers' preferences incorporate some degree of self-interest.

representative citizen-consumer, who is completely immobile. Countries impose a source-based tax on capital, which is freely mobile across countries. Tax revenues are used in part for the welfare of their representative citizen and in part to benefit only the policy-maker. They confirm both the tax competition model and the Leviathan hypothesis, showing that inter-jurisdictional competition for mobile capital distorts the allocation of resources between private and public sectors and that, if governments waste part of their tax revenues, then the competition is not necessarily harmful because the efficiency gain from the competition may be sufficient to outweigh the policy-maker's tendency to waste.

Rauscher (1998) explores whether inter-jurisdictional competition for mobile factors of production enhances public sector efficiency with the Leviathan model of government. His model consists of many small identical jurisdictions. In each jurisdiction, there are an immobile factor of production provided by government, i.e., infrastructure or institutional capital, and a mobile private capital. Governments produce a public good, which can be used for consumption and/or for the public sector input. Governments raise their revenues through lump-sum taxes and benefit taxes. Following the Leviathan model, governments are assumed to maximize rent. The rent is defined as the part of tax revenues which is not spent to provide the public good but consumed for government itself. He shows that, when benefit taxes are used to generate rent, then the inter-jurisdictional competition for the mobile capital leads to lower tax rates and improves welfare of citizens by forcing governments to redistribute the rent to the rest of the society. However, it is shown that inter-jurisdictional competition has no effect and even leads to inefficiency in the case of distortion free lump-sum taxes.

D. Summary of the Theoretical Analysis

Brennan and Buchanan (1980) argue that decentralization of tax and spending decisions and fragmentation of governmental units enhance competition among governments seeking to attract citizens and other mobile resources, and this competition, in turn, reduces Leviathan's excessive taxing power and, thus eventually, waste or rent. This Brennan and Buchanan's Leviathan hypothesis has been examined by formal theoretical studies with different assumptions on taxes used to finance government expenditures, on the mobility of citizens, and on the objective of government competition.

Despite such different assumptions, all formal theoretical analyses generally confirm the Leviathan hypothesis, demonstrating that, at least in some degree, inter-jurisdictional competition for mobile resources can constrain government rent-seeking behavior. Two key empirical predictions are a decentralization hypothesis and a fragmentation hypothesis. The fragmentation hypothesis predicts that the number of local governmental units in a public sector is inversely related to tax revenues, expenditures, and waste of governments. The decentralization hypothesis is that the degree of decentralization leads to lower levels of taxation, spending, and waste of local governments.

2-2-2. Empirical Evidence of Leviathan Hypothesis

Empirical studies on the Leviathan hypotheses analyze the effect of inter-jurisdictional competition on government fiscal performance. The degree of competition is usually measured by the total number of governmental units in a public market, which is defined based on various criteria, such as contiguity, geographical distance, and political jurisdiction. Based on the measure of government performance, these studies are roughly classified into three groups: studies of the public sector size, studies of the individual government size, and studies of the government technical efficiency. Studies suggest the negative relationship between the measure of competition and the public sector or the government size as evidence supporting the Leviathan hypothesis. These studies are summarized in Table 2-2.

A. Public Sector Size

The studies of public sector size examine the relationship between the intensity of competition within a public market and the sum of government revenues or expenditures within that public market. Therefore, the unit of analysis is the public market for government goods and services rather than any particular governmental unit in that public market. The public market is defined as a country, a state or a province, a Standard Metropolitan Statistical Area (SMSA), or a county. The results of public sector size studies are somewhat mixed.

Using both an international sample of 57 countries and a sample of 48 contiguous U.S. states, Oates (1972, 1985) conducted the first empirical test on the relationship between competition and public sector size. In his first international study (1972), he found that the centralization, which is measured by central government percentage of total government revenues, did not have any significant effect on the public sector size measured by tax revenues as a percent of national income. In his second U.S. state study (1985), the public sector size was measured by aggregate state and local tax revenues as a fraction of personal income. The degree of competition was measured by two centralization ratios and an index of decentralization. The two centralization ratios are the state share of state-local general revenues and the state share of state-local total expenditure. The decentralization index, which is usually interpreted as the measure of competition or fragmentation in the Leviathan literature, was the absolute number of local governments in a state. The regression results showed that there is no systematic relationship between the public sector size and the degree of competition within a state.

Using the same data set, Nelson (1987) modifies Oates's (1985) study by distinguishing between general-purpose and single-purpose governments. Dependent variables are three measures of state-local public sector size: state-local taxes per personal income, state-local expenditures per personal income, and local expenditures on fire protection per personal income. The degree of competition is measured by average population per local government within a state by the type of local government. The results show that, for all three measures of state-local public sector size, the coefficients on the average population per general-purpose government are positive and statistically significant. On the other hand, the coefficient on the average population per single-purpose government is found to have no statistically significant effect on all measures of state-local sector size.

Based on 2,900 counties and 280 SMSAs in the U.S., Eberts and Gronberg (1988) investigate the relationship between local public sector size and the degree of competition. The public sector size is measured by expenditures on the major local public services as a percentage of personal income in the public market, which is defined as the county, the SMSA, or the state. The degree of competition is measured by the number of governments, the number of governments per capita, and the number of governments per square mile. They find that, at the county and the SMSA levels, the three competition measures for general-purpose governments reduce and the three competition measures for single-purpose governments increase the public sector size. However, they find that the relationship between competition and the public sector size is not statistically significant at the state level, which is consistent with the results of Oates (1985).

Eberts and Gronberg (1990) examine the effects of fragmentation and concentration on public sector size using 128 U.S. SMSAs. This study extends their former study (1988) by classifying the public sector into suburb municipalities, central cities, and special districts, and by using different estimation methods. The public sector size is measured by own-source revenues per personal income and expenditures per personal income. Fragmentation is defined as the number of governments within a SMSA per 1,000 capita. Suburb concentration is calculated as the four most populated municipalities' share of suburban population and central city concentration is measured by the central city share of SMSA population. Their results support the Leviathan hypothesis, by showing that the fragmentation of the municipality reduces expenditures and own-source revenues of all three types of public sector and the suburb concentration increases suburban revenues.

Zax (1989) uses 3,022 counties in the U.S to examine the effects of competition and concentration on public sector size. He uses two measures of public sector size: own-source revenue per personal income and total tax revenue per personal income in a county, which is defined as the public market. He measures competition and concentration by the number of governments per square mile and the county share of total revenue, respectively. Like Nelson (1987) and Eberts and Gronberg (1988), he also distinguishes between general and single purpose governments in measuring the intensity of competition. He finds some evidence supporting the Leviathan hypothesis. The regression results show that, while competition among general-purpose governments reduces the public sector size, competition among special-purpose government does not have any significant effect on the public sector size. He also finds that concentration increases the size of public sector.

Stansel (2006) tests the relationship between competition and public sector size using a panel data set of 314 U.S. SMSAs from 1962 to 1992. The public sector size is measured by both the level and the growth of per capita local general expenditure and its share of money income. The number of local governments per 100,000 capita and the central city share of SMSA population are used as proxies for inter-jurisdictional competition. He finds that the number of general-purpose governments reduces both level and growth of expenditure share. However, it is found to have an insignificant relationship with both level and growth of per capita expenditure. The number of special-districts increases both the level and the growth of per capita expenditure and the growth of expenditure share. The central city share increases the level and the growth of per capita expenditure and the growth of expenditure share. These results are generally consistent with Leviathan hypothesis.

B. Individual Government Size

Compared to the public sector size studies, the individual government size literature is very thin. One finds only two studies, which examine the relationship between the size of individual government and the degree of competition in its respective public market. While the public sector size literature's unit of analysis is the public market, the individual government literature uses a specific type of government as the unit of analysis. The public market is defined based on a fixed geographic area or contiguity. The results of the two studies are inconsistent.

Forbes and Zampelli (1989) test the Leviathan hypothesis using data for 345 counties in 157 SMSAs. The dependent variable is the county government size measured by county taxes per dollar of income, county own-revenue per dollar of income, county taxes per capita, and county own-revenue per capita. They use the number of counties in the SMSA as the measure of inter-jurisdictional competition. Their results show that the number of counties in the SMSA has a positive and significant impact on the government size as measured by county taxes per capita, county own-revenue per capita, and county own-revenue per dollar of income. This finding is the opposite of the Leviathan hypothesis that an increase in inter-jurisdictional competition will decrease the size of the public sector. As a rationale for their results, they suggest that fragmentation may result in the loss of scale economies which, in turn, leads to an increase in the costs of providing public services.

Schneider (1989) investigates the effects of competition on government size using a panel data set on 839 suburban municipalities in 39 U.S. SMSAs. Government size is measured by total expenditure per capita. The intensity of competition in the public market is operationalized by the number of municipalities in an SMSA, the number of contiguous municipalities, and standard deviation of expenditures and tax bills. The number of municipalities measures alternative providers and standard deviations measures consumer choices. The results show that each of two measures of alternative providers and standard deviation of tax bills has negative effects on municipal expenditures. However, standard deviation in expenditures is found to have no significant effect on expenditures. Unlike Forbes and Zampelli (1989), these results support for Leviathan hypothesis by showing that competition constrains municipal expenditures.

C. Effect on Technical Efficiency

With the development of techniques measuring efficiency, more recent studies empirically explore the implication of competition among governments in terms of government technical efficiency. These studies usually use a two-step approach to examine the relationship between the intensity of competition and government technical efficiency. In the first stage, efficiency scores are estimated by econometric or mathematical approaches, and, then, the efficiency measures are regressed on measures of competition with other control variables in the second stage.

Using a panel data set of 101 Illinois municipalities in 1986, 1988, and 1990, Hayes, Razzolini, and Ross (1998) investigate the relationship between the degree of competitive pressure and the relative technical efficiency of local governments. They estimate the relative efficiency scores for municipalities with respect to the provision of police and fire services by the Indirect Output Distance Function (IODF) technique. The relative efficiency scores are, then, regressed on a set of socio-economic characteristics of municipalities, including dummy variables for Chicago suburbs and for urban areas. These two dummy variables are interpreted as measures for the degree of competition facing municipalities. They suggest that local governments under competitive pressures are more technically efficient in providing public services, showing that the relative efficiency scores of municipalities in Chicago suburbs and urban areas are higher than those of other municipalities in Illinois.

Grossman, Mavros, and Wassmer (1999) test the relationship between competition and technical inefficiency for 169 U.S. cities of 49 SMSAs from 1967 to 1982. To measure absolute technical inefficiency, they use the Stochastic Frontier Production Function

(SFPF) approach. The production function is constructed based on Brueckner's (1979, 1982) model of property value determination, which was originally developed for a test of allocative efficiency in the local public sector. The degree of competition is measured by the number of cities in the SMSA, the average population of cities in the SMSA, and the number of cities in the same U.S. census population group. They provide evidence in support of their hypothesis that competitive pressure acts as a check on technical inefficiency, showing that the number of cities in the SMSA and the average population of cities in the SMSA are inversely associated with the absolute technical inefficiency scores.

Hughes and Edwards (2000) evaluate technical efficiency for 87 counties in Minnesota and explore the cause of inefficiency. They measure both relative and absolute technical efficiency of the public sector, which is defined as the county, by using the Data Envelopment Analysis (DEA) and the Stochastic Frontier Production Function (SFPF) approach, respectively. Like Grossman, Mavros, and Wassmer (1999), they also construct both the DEA and the SFPF models based on Brueckner's (1979, 1982) property value determination model. Both the scale efficiency scores from the DEA and the absolute technical efficiency scores from the SFPF are regressed on the per capita number of local governments in a county, per capita total local expenditure in a county, and county's land area.[10] Tobit regression results support the Leviathan hypothesis, showing that the number of governments per capita increases both efficiency scores. The results also show that increasing county size as measured by land area reduces both efficiency scores of the public sector. This indicates that diseconomies of scale are present in the public sector.

10. Due to the lack of variation in the pure technical efficiency score from the DEA, they use the scale efficiency score as the dependent variable in the Tobit regression.

D. Summary of Empirical Studies

The Leviathan hypothesis has resulted in a relatively large number of studies empirically examining how inter-jurisdictional competition affects government behavior, especially in terms of government budget size. The theoretical analyses concern the impact of inter-jurisdictional competition more on the technical efficiency of public service provision rather than on the public sector size or the individual government size. However, empirical studies of the Leviathan hypothesis have concentrated not on technical efficiency but on the public sector size or the individual government size. The absence of a direct focus on technical efficiency reflects the difficulty of defining and measuring this concept in the context of local public services.

The empirical studies on the public sector size or the individual government size can be summarized as follows. First, the results of empirical studies on the effect of competition on the public sector or on the individual government size are inconsistent. While Schneider (1989), Zax (1989), Eberts and Gronberg (1990), and Stansel (2006) find evidence for the Leviathan hypothesis, Nelson (1987) and Forbes and Zampelli (1989) suggest the opposite. These inconsistent results may stem from differences in the definition of the public market, the unit of analysis, measures of competition, or measures of government size.

Second, there seems to be an important distinction between general-purpose governments and special-purpose governments in the public sector size literature. The public sector literature generally suggests that competition among general-purpose governments reduces the size of the aggregate public sector, while competition among special purpose governments may increase it. Third, local governments compete with each other in a public market which is geographically limited. While Oates (1985) and Nelson (1987), who use states as the unit of public market, do not find significant results, others generally find significant results.

While enormous attention has been given to public sector efficiency in the theoretical analyses, only a few studies have formally examined the link between government efficiency and the degree of inter-jurisdictional competition. In technical efficiency studies, while Hayes, Razzolini, and Ross (1998) and Grossman, Mavros, and Wassmer (1999) investigate the effect of competition on an individual government's technical efficiency, Hughes and Edwards (2000) explore the cause of the public sector's technical efficiency. Their results are consistent in that competition leads to the technical efficiency of individual governments and the overall public sector. Although these results are consistent with the theoretical proposition of Leviathan hypothesis, further empirical evidence is required to draw a more general and definitive conclusion.

Table 2-2. Summary of Empirical Studies on Leviathan Hypothesis

Study	Unit of Analysis	Public Market [1]	Method [2]	Measure of Government Performance [3]	Measure of Competition [4,5]	Effect on Government Performance [6]
I. Public Sector Size						
Oates (1972)	Country (1968)	Country	OLS	Tax revenues as a percent of national income	CGSR	Negative (NS)
(1985)	State, US (1977)	State	OLS	State-local tax revenues per personal income	NG, SSR, SSE	Negative (NS)
Nelson (1987)	State, US (1977)	State	OLS	State-local tax revenues per personal income (R) State-local expenditures per personal income (E) Expenditures on fire per personal income (F)	NGP NSP	Positive Negative (NS in R), Positive (E)
Eberts & Gronberg (1988)	County and SMSA, US (1977)	County SMSA	OLS	Expenditures per personal income	NG, NGP, NGM NS, NSP, NSM	Negative Positive
Zax (1989)	County, US (1982)	County	OLS	Own-source revenue per personal income (O) Tax revenue per personal income (T)	NGP NGM NSP NSM CSR	Negative (NS in O), Positive (T) Negative (NS in T) Positive Negative (NS) Positive
Eberts & Gronberg (1990)	SMSA, US (1977)	SMSA	SUR	Own-source revenue per personal income Expenditures per personal income	NGP, CCC NSP, FSC	Negative Positive
Stansel (2006)	SMSA, US (1962-1992)	SMSA	OLS	Growth in expenditure per capita Growth in expenditure share of income	NGP NSP CSP	Negative Positive Positive (NS)
II. Individual Government Size						
Forbes & Zampelli (1989)	County, US (1977)	SMSA	OLS ML	Tax revenue per dollar of income Tax revenue per capita Own-revenue per dollar of income Own-revenue per capita Employee wage	NG	Positive (NS in OLS) Positive Positive Positive Negative (NS)

(Continued)

Table 2-2. (Continued)

Study	Unit of Analysis	Public Market [1]	Method [2]	Measure of Government Performance [3]	Measure of Competition [4,5]	Effect on Government Performance [6]
II. Individual Government Size (Continued)						
Schneider (1989)	Municipality, US (1972, 77, 82)	SMSA Contiguity	FE	Expenditure per capita	NG, NGC, VT VE	Negative Positive (NS)
III. Technical Efficiency						
Hayes et al. (1998)	Municipality in IL, US (1986, 88, 90)	State	OLS	Technical efficiency by IODF	DS DU	Positive Positive
Grossman et al. (1999)	City, US (1967, 73, 77, 82)	US SMSA	ML	Technical inefficiency by SFPF	NG, PNC NGS	Negative Negative (NS)
Hughes & Edwards (2000)	County in MN, US (1987)	County	Tobit	Scale efficiency by DEA Efficiency by SFPF	NTP NTP	Positive Positive (NS)

1. SMSA-standard metropolitan statistical area.
2. FE-Fixed effects, ML-Maximum likelihood, OLS-Ordinary least squares, and SUR-Seemingly unrelated regression.
3. DEA-Data envelopment analysis, IODF-Indirect output distance function, and SFPF-Stochastic frontier production function.
4. Measure of fragmentation: DS-Dummy for Chicago suburb, DU-Dummy for urban area, NG-Number of general purpose government, NGC-Number of government sharing border, NGM-Number of general purpose government per square miles, NGP-Number of general purpose government per capita or 1000 persons, NGS-Number of comparable-sized government, NS-Number of special purpose government, NSP-Number of special purpose government per capita or 1000 persons, NSM-Number of special purpose government per square miles, NT-Number of independent government, NTP-Number of independent government per capita or 1000 persons, VE-Variation in expenditure, and VT-Variation in the tax bill.
5. Measure of concentration: CCC-Central city concentration ratio, CGSR-Central government share of total government revenues, CSP-Central city share of SMSA population, CSR-County share of total revenue, FSC-Four suburb concentration ratio, HHI-Herfindahl-Hirschman index of market concentration, MSG-Market share of the individual government, PNC-Average population of non-central cities in the SMSA, SSE-State share of state-local total expenditure, and SSR-State share of state-local general revenue.
6. NS-Not significant at the conventional confidence levels.

2-4. Yardstick Competition

A recent justification for the existence of fiscal competition among local governments is the yardstick competition theory. As a means of creating incentives for elected representatives to emulate neighbors' policies and to provide public goods in accordance with citizen-voters' preferences, the yardstick competition theory gives its attention to the role of periodic elections, which are ignored in the Tiebout (1956), the tax competition, and the Leviathan models. While the political process is absent in the Tiebout and the tax competition models by implicitly or explicitly assuming that the preferences of residents are identical, the Leviathan hypothesis argues that electoral constraints are inadequate to limit government.

The main idea of the yardstick competition theory is that citizen-voters use other jurisdictions as a yardstick against which they evaluate their incumbents' performance when deciding their votes, and, due to their concerns for re-election, citizen-voters' retrospective voting based on this comparative performance evaluation induces incumbents to emulate competitors' policies and to perform better than competitors. Formal theoretical analyses examine this intuitive idea under various situations and, in general, show that yardstick competition reduces incumbents' rent-seeking behaviors and enhances government efficiency. Empirical studies have explored the presence of yardstick competition by estimating a popularity equation or a policy reaction function. Most empirical studies provide evidence for the presence of the yardstick competition.

2-4-1. Theoretical Analysis

The yardstick competition theory typically relies on a principal-agent framework with information asymmetry between citizen-voters and elected representatives about the costs and benefits of public goods (Besley and Case, 1995). Salmon (1987) examines whether competition between governments can solve both the information asymmetry and the lack of incentives for politicians to behave in the interests of citizen-voters. He suggests that the retrospective voting strategy based on relative performance evaluation can solve the information asymmetry and incentive problems. Subsequent formal theoretical studies examine Salmon's (1987) yardstick competition thesis, exploring the effect of the retrospective voting based on comparative performance evaluation on the incumbents' rent-seeking behavior within various political agency frameworks.

A. Origin of Yardstick Competition Theory in the Public Sector

In a representative democracy, citizen-voters delegate the power over public spending and taxes to elected representatives. This delegation of power to the elected representatives gives rise to a principal-agent relationship between citizen-voters and elected representatives (Von Hagen and Harden, 1996). In this principal-agent relationship, one of the main problems is an information asymmetry, which makes it difficult for citizen-voters to judge the performance of their elected representatives. The information asymmetry between politicians and citizen-voters, in turn, provides elected representatives substantial managerial slack or rents (Salmon, 1987). The agency problem between politicians and citizen-voters and issues of asymmetric information between them has been extensively considered in political science (Wrede, 2001).

The political science literature has explored how politicians can be induced to behave in accordance with the interests of the citizen-voters. A number of studies have stressed the role of retrospective voting in elections as a means of constraining the politicians who seek rent. Theories of voting have distinguished between prospective and retrospective evaluations of politicians. Prospective voting models suggest that even if voters evaluate candidates' past performance, they use this retrospective evaluation as a predictor of future performance and vote based on a candidates' future promise (Downs, 1957). Retrospective voting models argue that voters evaluate incumbents' past performance and then reelect incumbents if the past performance of the incumbents exceeds some given performance standard (Key, 1966; Fiorina, 1981).

The retrospective voting model gives its attention to the role of repeated elections in constraining the politicians who seek rent. Especially, Barro (1973) and Ferejohn (1986), among others, suggest that a major role of repeated elections is to create incentives for politicians to behave in accordance with the interests of citizen-voters by rewarding or punishing them in elections based on their past performance. The retrospective voting model assumes that there is a cut-off level or critical level of government performance which citizen-voters use to decide whether to punish or reward their incumbents. However, the retrospective voting model does not explain how voters can set the cut-off level of incumbents' performance or how they can get information on it if it exists. As Salmon (1987) suggests, it is not easy for citizen-voters to get direct information on the absolute or cut-off level of incumbents' performance.

Although an absolute performance evaluation is impossible, citizen-voters are still able to evaluate the performance of their incumbents in terms of rank-order by comparing their incumbents' performance with other governments' performance. Tournaments theory, which was developed by Lazear and Rosen (1981), Baiman and Demski (1980), and Holmström (1982), among others, in labor economics, provides the basis of the comparative performance evaluation. The tournaments theory argues that although the absolute level of performance of individual agents within the organization cannot be observed by their superiors, their relative performance can be assessed in terms of rank-order. Shleifer (1985) coined the term of "yardstick competition" in applying the tournaments theory to regulation schemes of franchise monopolies.

The retrospective voting model and the relative performance evaluation of tournaments theory are combined into Salmon's (1987) yardstick competition thesis. Salmon (1987) suggests that the combination of the retrospective voting strategy and the comparative performance evaluation can overcome or relieve the information asymmetry problem and create incentives for politicians to do a better job. Even though citizen-voters are poorly informed about the performance or policies of their incumbents, they are still able to properly evaluate the performance of their incumbents by comparing their incumbents' performance to that of other governments. If citizen-voters reward or punish their incumbents based on the relative performance evaluation in an election, this creates incentives for incumbents to do better than incombents in other jurisdictions. Thus, the retrospective voting strategy based on comparative performance evaluation can induce politicians to engage in competition and prevent them from rent-seeking.

B. Formal Theoretical Analysis of Yardstick Competition

With various political agency models, formal theoretical studies have examined Salmon's (1987) idea of yardstick competition in the decentralized local government system. All models have in common assumptions that there is an information asymmetry between citizen-voters and politicians about policies, political rents, or incumbent types, that citizen-voters compare their incumbents' performance to that of neighboring, and that citizen-voters decide whether or not to reelect their incumbents based on this comparative performance evaluation in elections. The main interests of formal theoretical analyses are in whether yardstick competition can reduce politicians' rent-seeking behaviors and enhance citizen-voters' ability to distinguish between bad politicians and good ones.

Besley and Case (1995) examine how yardstick competition affects incumbents' reelection chances and incumbents' rent-seeking behavior. They develop a yardstick competition model of tax setting with two jurisdictions. Each jurisdiction is run by elected representatives, who potentially either do or do not seek rent. The incumbents know more about the cost of public services than the citizen-voters. The bad incumbent seeks rent by charging more than the cost of services in taxes. The incumbents know each other's type, good or bad. Besley and Case demonstrate that voters' retrospective voting based on relative performance evaluation forces incumbents into a yardstick competition in which they care about other jurisdictions' taxing behavior before setting their own taxes due to concerns for reelection. They conclude that this yardstick competition distinguishes good politicians from bad ones, and reduces bad incumbents' rent-seeking behavior and their reelection probability.

Wrede (2001) explores whether yardstick competition can tame the Leviathan. He compares a multi-candidate model with a two-party model. All politicians are assumed to be Leviathans who maximize expected rents. Policy costs consist of political rent and the costs of public services. Citizen-voters can observe the realized total policy costs but not the rents while politicians know their rents. Wrede demonstrates that a retrospective voting strategy based on relative performance evaluation prevents politicians from rent-seeking in both the multi-candidate and the two-party model. The possibility of taming the Leviathan is higher in the multi-candidate model than in the two-party system. The results also suggest that citizen-voters not only discipline their elected representative but also implicitly participate in taming the Leviathan in the other jurisdiction.

Besley and Smart (2002) examine whether yardstick competition prevents incumbents from rent-seeking and helps voters to distinguish between good and bad politicians. They construct a political agency model with two jurisdictions. Politicians are assumed to be either benevolent welfare maximizers or Leviathans. Citizen-voters observe the quantity of public goods and the total government spending but they can not know the types of incumbent and challenger, the unit cost of public goods, and the amount of rent. The results show that the effects of yardstick competition depends on how likely it is that politicians are bad. When politicians are benevolent, then yardstick competition is a valuable means of generating better information about the type of the incumbent. However, when politicians are of the Leviathan type, yardstick competition may have effects encouraging incumbents to seek rent.

Belleflamme and Hindricks (2005) examine how yardstick competition affects the possibility that incumbents engage in rent-seeking. They consider a multi-jurisdiction version of a political agency model in which politicians' rents are modeled as a cash transfer from voters to a special interest group. Each incumbent may be either good or bad. A good incumbent always behaves in the interests of citizen-voters, while a bad incumbent may do rent-seeking at the cost of citizen-voters. There is asymmetric information between the incumbents and citizen-voters about the type of incumbents and the desirability of a public policy. They show that yardstick competition can reduce and even eliminate the risk of undertaking non-valuable policies by improving the ability of citizen-voters to detect those policies that are not in their interest.

C. Summary of Theoretical Analysis

Salmon (1987) developed yardstick competition theory in the decentralized local public sector by combining the theory of labor tournaments and the retrospective voting model. The main idea of Salmon's yardstick competition theory is that in a decentralized government system, citizen-voters use performance of neighboring governments to appraise their government's performance, citizen-voters decide their vote based on this comparative evaluation in elections, and this induce their own government to do as well as better than neighboring governments. Formal theoretical models have examined the initial formation of Salmon's yardstick competition, focusing on two effects of yardstick competition, a "discipline effect" and a "selection effect" (Revelli, 2006, p.463).

All formal theoretical analyses confirm the selection effect of yardstick competition, showing that, by providing information about the type of incumbents, yardstick competition can help citizen-voters to distinguish bad politicians and good ones and, thus, punish bad ones and reward good ones in elections. Regarding the discipline effect, most formal theoretical analyses also demonstrate that citizens' retrospective voting strategy based on relative performance evaluation in elections constrain incumbents' rent-seeking behaviors. However, Besley and Smart (2002) suggest that, when incumbents are Leviathan types, yardstick competition may make things worse, encouraging incumbents to seek rent.

Yardstick competition models provide several theoretical propositions, which can be empirically testable. First, yardstick competition theory predicts that government policies tend to be correlated among neighboring jurisdictions. Theoretical analyses of yardstick competition suggest that if citizen-voters take into account policies in neighboring jurisdictions, incumbents are forced to consider policies in neighboring jurisdictions too and, thus, set their policies in line with those in neighboring jurisdictions in order to be reelected.

Second, yardstick competition theory predicts that electoral results in a jurisdiction depend both on own policy and on neighboring jurisdictions' policies. In the yardstick competition models, citizen-voters make relative evaluation of their incumbents' performance based on neighboring governments' performance and they decide their votes based on this comparative evaluation. Consequently, the popularity or reelection probability of incumbent in a jurisdiction is related to own policy and neighboring jurisdictions' policies.

Third, yardstick competition theory provides a proposition that inter-jurisdictional competition leads to technical efficiency in providing public goods by reducing government waste or rent. Except for Besley and Smart's (2002) model in which incumbents are Leviathans, all other formal theoretical analyses demonstrate that citizen-voters' retrospective voting strategy with comparative performance evaluation in elections enhances technical efficiency in local public service provision by constraining incumbents' rent-seeking behaviors.

2-4-2. Empirical Evidence of Yardstick Competition

While formal theoretical studies have focused on the consequences of yardstick competition, empirical studies have examined exclusively the presence of yardstick competition. These empirical studies can be classified into popularity studies and spatial policy interdependency studies. To discriminate yardstick competition from alternative explanations, popularity studies examine the effect of fiscal policies on election results and spatial policy interdependency studies test a link between spatial interaction in a fiscal policy and rules or institutions, which are assumed to affect governments' policy mimicking behaviors. Although yardstick competition can take place in various policy areas, only empirical studies on yardstick competition in tax policies are reviewed. [11] Table 2-3 provides the summary of these empirical studies.

A. Popularity Study

To verify yardstick competition and to discriminate it from other theories, popularity studies investigate the effect of own and neighboring governments' tax policies on incumbents' vote share or reelection probability. The rational of this approach is that an impact of neighboring governments' tax policies on an incumbent's popularity or reelection chances can hardly be explained by other theories than yardstick competition. As empirical evidence for the presence of yardstick competition, these studies suggest a positive effect of neighbors' tax rates and a negative effect of own tax rate on incumbents' vote share or reelection chances.

Case (1993) first examines the existence of yardstick competition based on panel data of U.S. 48 states from 1979 to 1988. First, she estimates an incumbents' defeat equation, which relates governors' defeat to own and neighboring states' income tax changes. As yardstick competition theory predicts, the results show that the incumbent's

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11. For empirical studies on yardstick competition in government expenditures, see, for example, Bivand and Szymanski (2000) for expenditures on garbage collection in UK districts and Revelli (2006) for social spending in UK local governments.

defeat is positively related to own income tax increases and negatively related to neighbors' income tax increases. Second, using tax setting equations, she compares states' sensitivity to neighbors' income tax changes between states in which governors are eligible for reelection and those in which governors are ineligible for it, and between before and after the Tax Reform Act of 1986 (TRA86), which reduces federal marginal tax rates. Her findings are consistent with yardstick competition theory. The results show that states' tax changes are positively related to neighbors' tax changes, governors ineligible for reelection are less sensitive to neighbors' tax changes than governors eligible for reelection, and governors became more sensitive to neighbors' behavior after the TRA86.

Based on panel data of 48 U.S. states from 1960 to 1988, Besley and Case (1995) provide empirical evidence for yardstick competition. To discriminate yardstick competition from alternative theories, they estimate both the reelection probability equation, in which the probability of incumbent defeat is a function of the tax change of own state and its neighbors' tax changes, and the tax change equation, which relates the tax change in a state to its characteristics and its neighbors' tax changes. In both equations, neighbors are defined based on contiguity. The results of the reelection probability equation show that own tax increases raise the probability of incumbent defeat and neighbor's tax increases reduce the probability. The tax change equation results show that governors ineligible for reelection are less sensitive to neighbor states' tax changes than governors eligible for reelection. These results are consistent with yardstick competition theory but hardly reconcile with the tax competition theory.

Based on panel data of the English districts from 1979 to 1990, Revelli (2002a) examines yardstick competition by estimating a popularity equation. In the popularity equation, the vote share of the incumbent party is a function of own property tax rate and neighbors' property tax rates and neighbors are assigned to each district based on contiguity. He estimates the popularity equation separately for the 87 districts having annual by-third elections and for the 122 districts having all-out elections every four years. He provides little evidence of yardstick competition. As yardstick competition theory suggests, the results show that own tax rates have a negative impact and neighbors' tax rates have a positive impact on incumbent's vote share. However, only the coefficient on own tax rates is statistically significant in the sample of 87 by-thirds election districts. Furthermore, after controlling for the influence of national politics, the estimated coefficients on own and neighbors' tax rates become less significant.

Vermeir and Heyndels (2006) analyze municipal elections of 1988, 1994, and 2000 in 307 Flemish municipalities and suggest some evidence for the existence of yardstick voting. They estimate a popularity equation relating the vote share of incumbent party to income tax rates, property tax rates, and per capita expenditures of own and neighboring municipalities. They define border sharing municipalities as neighbors to each municipality. Their results show that although neighbors' income and property tax rates are insignificant at the conventional levels, neighbors' expenditures have a negative and statistically significant impact on the vote share of incumbent party. These results support the yardstick competition theory that voters use fiscal policies in neighboring municipalities as a yardstick.

Using a panel data set on elections of 2,799 Spanish municipalities in 1991, 1995, 1999 and 2003, Bosch and Solé-Ollé (2007) investigate yardstick voting behavior. They estimate a popularity equation, in which the incumbent parties' vote share is a function of own and neighboring municipalities' property tax changes and the neighbors are assigned to each municipality based on distance. They provide strong evidence for yardstick competition among Spanish municipalities. The IV regression results show that, while the municipality's own property tax increases have a negative and statistically significant impact on the incumbent parties' vote share, property tax increases in neighboring municipalities have a positive and statistically significant effect on it.

B. Spatial Policy Interdependency Study

Using various political factors which can generate differences in politicians' policy mimicking behaviors, spatial policy interdependency studies try to discriminate yardstick competition from alterative theories. Such political factors include term limits, ideologies of incumbent governments, direct democracy institutions, degree of autonomy, party systems, and degree of incumbents' popularity. Some studies incorporate an interaction term between neighbors' tax rates and a political factor in a tax rate reaction function, and examine the effect of the interaction term. Other studies split data into two or more sub-data sets, based on a political factor, and compare the magnitude of the coefficient on neighbors' tax rates between sub-data sets.

Heyndels and Vuchelen (1998) examine yardstick competition in income and property tax rate setting of 589 Belgian municipalities. In estimating income and property tax rate reaction functions, they define neighbors based on both the first and the second order contiguity. The second order neighbors are municipalities sharing a common border with the first order neighbors, excluding the first order neighbors. Their results show that the coefficient on the neighbors' tax rates is positive and significant in both the income and property tax equations. The intensity of the impacts diminishes with geographical distance, showing that the coefficient on second order neighbors' tax rates is smaller than that on first order neighbors' tax rates. They suggest the above results as evidence for yardstick competition. However, the results also can be attributed to tax competition.

Revelli (2001) examines yardstick competition in property tax rate setting of 296 UK non-metropolitan districts for the years 1983-1990. He estimates a property tax rate reaction function, which incorporates both the horizontal competition among districts and the vertical interaction between districts and counties. In estimating the reaction function, neighbors are assigned to each district based on contiguity. The results show that while the coefficient on neighbors' tax rates is positive and statistically significant, the coefficient on county tax rates is statistically insignificant. This confirms the presence of competition among districts but not the vertical interaction between districts and county in property tax rate setting. Like Heyndels and Vuchelen (1998), this study can not eliminate the possibility that the results are also explained by tax competition.

Schaltegger and Küttel (2002) investigate yardstick competition in expenditures, revenues, and tax revenues of 26 Swiss cantons from 1980 to 1998. To discriminate yardstick competition from alternative sources of competition, they compare the mimicking behavior of incumbents by the extent of direct democracy and by the degree of autonomy. In their models, neighbors are defined as cantons in the same statistical region. Their results show that in all three fiscal policy equations, the coefficient on neighbors' policies is positive and significant and the coefficient on the interaction between neighbors' policies and direct democracy is negative and significant. These results support their yardstick competition hypothesis that fiscal policy decisions are copied among neighbors and incumbents under strong direct democracy engage less in this policy mimicking.

Bordignon, Cerniglia, and Revelli (2003) investigate yardstick competition, based on the business property tax rate of 143 municipalities in Italy. To test whether the tax mimicking behavior can be attributed to yardstick competition, they divide the data set into two and three parts based on term limits and the size of the majorities supporting mayors, and then estimate a tax rate reaction function for each sub-data set. In the reaction function, neighbors are defined based on contiguity criterion. The results show that the coefficient on neighbors' tax rates is positive and significant only in municipalities where either the mayors run for re-election or are not backed by large majorities, but it is not statistically significant in municipalities where either mayors face a term limit or are backed by large majorities. These results are consistent with their yardstick competition hypothesis that the mayors with term limits or the mayors supported by large majorities tend to be less sensitive to neighboring municipalities' property tax rates.

Solé-Ollé (2003) investigates yardstick competition in the property tax rate, the motor vehicle tax rate, and the local business tax rate of 105 Spanish municipalities during the period 1992-1999. To discriminate yardstick competition from competing theories, he compares mimicking behavior of incumbents by the ideology of incumbent parties and by the degree of electoral margin. He defines neighbors based on the geographic distance. His findings provide evidence for the presence of mimicking behavior in tax rate setting, showing that there is a significant positive response of property and vehicle tax rates to neighbors' tax rate changes. Furthermore, his findings suggest that this mimicking behavior is attributed to the yardstick competition, showing that the reaction of governments on the left tends to be much lower than that of governments on the right for property and business taxes and mimicking behavior decreases as the electoral margin increases for all three taxes.

Allers and Elhorst (2005) analyze the mimicking behavior in property tax rates of 496 Dutch municipalities. To investigate whether the source of tax mimicking is yardstick competition, they compare mimicking behaviors between governing parties backed by a large majority and those depending on a small majority. In estimating a reaction function, neighbors are defined based on the contiguity criterion. They find that Dutch municipalities are engaged in tax mimicking, showing that the coefficient on neighbors' tax rates is positive and significant. They also find that, as the yardstick competition hypothesis predicts, governing parties backed by a large majority mimic neighboring tax rates to a lesser extent than those depending on a small majority. This result suggests yardstick competition as the most likely source of tax mimicking.

C. Summary of Empirical Studies

Empirical studies have tried to look for evidence for the presence of yardstick competition and to discriminate yardstick competition from alternative theories, especially tax competition. Several studies have attempted to test the yardstick competition directly by estimating a popularity equation that relates incumbents' vote share or reelection chances to their jurisdictions' tax policies as well as neighboring or competing governments' tax policies. Except for Revelli (2002a), all other studies provide empirical evidence for yardstick competition, showing that a given jurisdiction's tax increase reduce the incumbent's vote share or reelection chances while increases in neighbors' taxes increase the vote share or the reelection probability.

To discriminate yardstick competition from other expiations, spatial policy interdependency studies test a link between incumbents' policy mimicking behaviors and political factors, which are assumed to affect the mimicking behavior. All these studies point to yardstick competition as the source of the observed spatial autocorrelation in tax policies among local governments. On the other hand, Heyndels and Vuchelen (1998) and Revelli (2001) suggest the statistically significant coefficient on neighbors' tax policies as evidence for yardstick competition, but they do not rule out tax competition as an alternative explanation of their results.

While empirical studies have provided sufficient evidence verifying the presence of yardstick competition, the effect of yardstick competition on government waste are rarely examined. Salmon's (1987) initial formation of yardstick competition was initiated by his concern about the potential effect of inter-jurisdictional competition constraining politicians' rent-seeking behavior in a decentralized local government system. Therefore, subsequent formal theoretical analyses have also focused on examining whether yardstick competition can constrain politicians' rent-seeking behavior. The effect of yardstick competition on government waste can be tested by comparing the degree of government waste or technical inefficiency between jurisdictions in which yardstick competition takes place and jurisdictions in which it does not take place.

Table 2-3. Summary of Empirical Studies on Yardstick Competition

Study	Unit of Analysis	Neighbors	Method [1]	Dependent Variable	Independent Variable [2]	Findings of Interaction [3]
I. Non-Spatial Popularity						
Case (1993)	State, US (1979-1988)	Contiguity	Probit	Governor's defeat	Own income tax change Neighbors' income tax change	Positive (NS) Negative (NS)
Besley & Case (1995)	State, US (1977-1988)	Contiguity	Probit	Governor's defeat	Own income tax change Neighbors' income tax change	Positive (NS) Negative
Revelli (2002a)	District, UK (1979-1990)	Contiguity	IV, GMM	Incumbent vote share	Own property tax rate Neighbors' property tax rate	Negative (NS) Positive (NS)
Vermeir & Heyndels (2006)	Municipality, Belgium (1988-2000)	Contiguity	IV	Incumbent vote share	Neighbors' property tax rate Neighbors' income tax rate Neighbors' per capita expenditure	Positive (NS) Positive (NS) Negative
Bosch & Solé-Ollé (2007)	Municipality, Spain (1991-2003)	Distance	IV	Incumbent vote share	Neighbors' property tax change	Positive
II. Spatial Policy Interdependency						
Case (1993)	State, US (1979-1988)	Contiguity	IV	Income tax change	$Wy \times$ TLD $Wy \times$ TRA86	Negative Positive
Besley & Case (1995)	State, US (1960-1988)	Contiguity	IV	Income tax change	Wy by term limit and non-term limit states	Negative (NS) in term limit Positive in non-term limit
Heyndels & Vuchelen (1998)	Municipality, Belgium (1991)	1st order contiguity 2nd order contiguity	IV	Property tax rate Income tax rate	Wy	Positive
Revelli (2001)	District, UK (1983-1990)	Contiguity	GMM	Property tax rate	Wy County property tax rate	Positive Positive (NS)

(Continued)

Table 2-3. (Continued)

Study	Unit of Analysis	Neighbors	Method [1]	Dependent Variable	Independent Variable [2]	Findings of Interaction [3]
II. Spatial Policy Interdependency (Continued)						
Schaltegger & Küttel (2002)	Canton, Switzerland (1980-1998)	Contiguity Socio-economic similarity Statistical region	IV	Expenditure per capita Revenue Revenue per capita	Wy Wy × DDD	Positive Negative
Bordignon et al (2003)	Municipality, Italy (2000)	Contiguity	ML	Property tax rate	Model A Wy × TLD Wy × NTLD Model B Wy × TLD Wy × TLMBD Wy × TLNMD	 Positive (NS) Positive Positive (NS) Negative (NS) Positive
Solé-Ollé (2003)	Municipality, Spain (1992-1999)	Distance Socio-economic similarity	IV	Property tax rate (P) Motor vehicle tax rate (M) Business tax rate (B)	Wy EM EM × Coalition government EM × Left wing government EM × Communist government EM × Independent government	Positive (NS in B) Positive (NS in M) Positive (NS in P, M) Positive (NS in B, M) Positive (B), Negative (P, M) Positive (NS in M)
Allers & Elhorst (2005)	Municipality, Netherlands (2002)	Contiguity	ML	Property tax rate	Wy Wy by Level of council support Wy by Ideology Wy by Political fragmentation	Positive Positive (MS<NMS) Positive (RW=NRW) Positive (FG=NFG)

1. GMM-Generalized method of moments, IV-Instrumental variables, and ML-Maximum likelihood.

2. DDD-Direct democracy dummy, EM-Electoral margin, NTLD-No term limits dummy, TLD-Term limits dummy, TLMBD-Term limits and majority backing dummy, TLNMD-Term limits and non-majority backing dummy, and Wy-Spatially lagged dependent variable (Average of neighbors' dependent variable).

3. ACCT-After Compulsory Competitive Tendering (CCT), BCCT-Before CCT, ASSPR-After the System of Social Service Performance Rating (SSPR), BSSPR-Before SSPR, FG-Government with fragmented political party, MS-Government supported by majority party (75%), NFG-Government with not fragmented political party, NMS-Government not supported by majority party, NRW-Government not controlled by right wing party, RW-Government controlled by Right wing party, and NS-Not significant at the conventional confidence levels.

2-5. Intra-jurisdictional Competition

In addition to the inter-jurisdictional competition, fiscal interaction or competition also exists between different levels or types of government, such as between the federal government and the states, between a state and its counties, and between a municipality and a special district. On the revenue side of the budget, the intra-jurisdictional interaction arises from tax base sharing or co-occupancy of the tax base between different levels or types of government. This tax base co-occupancy is common in the federal system of government. Although this vertical or intra-jurisdictional interaction can arise in the spending side of the government budget, only the theoretical and empirical literature on the revenue side is reviewed for the purposes of this study.[12]

2-5-1. Theoretical Analysis

Two aspects of intra-jurisdictional interaction have been analyzed in the theoretical literature: interdependency between different levels or types of government and equilibrium tax levels. On the revenue side of the budget, intra-jurisdictional interaction arises when two or more governments impose taxes on a shared tax base. In this case, if one government increases its tax rates, the other governments face a reduced tax base. One issue in this negative vertical externality concerns the way in which the change in the tax rate of a government affects the others' choices of tax rates. Few theoretical analyses have discussed the sign of this interdependency, especially, in the U.S. context.

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12. The vertical interaction on the expenditure side of the budget also has been explored in the literature. For theoretical analysis, see, Dahlby (1996) and Dahlby and Wilson (2003). For empirical studies, see Turnbull and Djoundourian (1993) for general, police, and transportation expenditures between municipalities and counties in 5 U.S. states, Aronsson et al. (2000) for expenditures between municipalities and counties in Sweden, and Campbell (2004) for expenditures between municipalities and counties in US.

On the other hand, the equilibrium tax level analysis has focused on the allocative efficiency implication of intra-jurisdictional competition arising from tax base sharing by comparing the equilibrium tax levels of overlapping governments with those of unitary or coordinated cases. Based on the relationship between governments sharing a tax base, the equilibrium analyses can be classified into a hierarchical case and a non-hierarchical or co-equal case. More recent equilibrium analyses extend the hierarchical intra-jurisdictional interaction studies by allowing inter-jurisdictional competition among the lower level of governments. In the non-hierarchical case, inter-jurisdictional competition for mobile factors can not exist by its nature.

All formal theoretical equilibrium studies utilize game theoretic frameworks. The game theoretic frameworks can be classified into either a Nash game or a Stackelberg game framework. In the Nash game framework, it is assumed that both levels of government simultaneously set their tax rates and ignore the vertical externality imposed on the other level or type of government. On the other hand, the Stackelberg game framework assumes that the higher level of government sets its tax rate first and takes into account the effects of its tax policy on the lower level of governments. Then, the lower level of governments react to the higher level of government's decision.

A. Interdependency Studies

When two or more governments share a tax base, does an increase in tax rates of a government lead to an increase or to a decrease in tax rates of the others? The theoretical analysis on this interdependency in tax policies offers four possible factors affecting the reaction of one level of government to the change in the tax rate of the other level of government: a revenue effect, a deadweight loss effect, an expenditure effect, and a tax substitutability or complementarity effect. Boadway and Keen (1996) derive the last two effects in considering the effect of a federal labor tax on the state labor tax. Besley and Rosen (1998) provide a theoretical framework incorporating all four effects in the case of U.S. federal and state commodity taxes. Keen (1998) also considers the sign of states' response to the change in federal tax rate in the case of commodity taxes.

The revenue effect represents the reaction of the one level of government to maintain its revenues when the other level of government raises its tax rate. An increase in tax rate of the one level of government leads to a decrease in tax revenues of the other level of government, when two different levels of government share the same tax base. To maintain tax revenues, this negative externality requires the each level of governments to raise their tax rates (Besley and Rosen, 1998). Thus, the sign of the revenue effect is positive.

When the negative externality created by intra-jurisdictional interaction exists, the expenditure effect denotes the reaction of the one level of government to increases in tax rates of the other level government by adjusting expenditure levels to the reduced tax base. Each level of government may react by reducing expenditure levels and thereby its tax rate when the other level of government raises its tax rate (Besley and Rosen, 1996; Boadway and Keen, 1996). Thus, the expenditure effect takes a negative sign.

The tax substitutability or complementarity effect occurs between different taxes. A change in the tax rate on one tax base may have an impact on the tax revenues from the tax on another tax base because the tax bases are substitutes or complements. Substitutability or complementarity between different tax bases lead to a more complex and ambiguous response of one level of government to tax rate changes of the other level of government (Besley and Rosen, 1998; Boadway and Keen, 1996).

The sign of the deadweight loss effect depends on whether each level of government takes into account only its own excess burden or the total excess burden when setting its tax rate. If each level of government ignores the excess burden created by the other level of government, an increase in tax rate of one level of government leads to an increase in tax rate of the other level of government. However, if each level of government considers the total excess burden, a higher tax rate of one level of government induces the other level of government to lower its tax rate (Besley and Rosen, 1998). Therefore, the sign of the deadweight loss effect is theoretically ambiguous.

In sum, the direction of a given government's reaction to a change in the tax rate of the other governments is theoretically ambiguous. The tax base of the other level of government decreases, when one level of government increases its tax rate. Then, the other level of government can respond by adjusting its revenue or expenditure policies. If the other level of government chooses to maintain its revenues, it can respond by increasing its tax rate. On the other hand, the other level of government can lower its tax rate if it chooses to decrease its expenditures. In addition to the revenue effect and the expenditure effect, considering the tax substitutability or complementarity effect and the deadweight loss effect makes the direction of interdependency more complex and ambiguous.

B. Equilibrium Analyses of Hierarchical Cases

Early theoretical equilibrium analyses examine the intra-jurisdictional competition in a hierarchy of governments, especially between the federal and state governments in the U.S. context. Flowers (1988) was the first to analyze intra-jurisdictional competition in tax rate setting in a hierarchical case within a Nash game framework. With either a Nash or a Stackelberg game framework, more recent formal theoretical studies examine not only the vertical interaction between different levels of government in a federal system, but also the horizontal competition among the lower level of governments.[13]

Within a Nash game framework and a Leviathan model of government, Flowers (1988) examines intra-jurisdictional competition in tax rates between a federal government and a single state government. Flowers finds that if one level of government raises its tax rate, the other level of government lowers its own tax rate by a smaller amount than required to offset the initial increase. This underestimation of the negative fiscal externality between the two levels of government leads both levels of government to impose a higher tax rate on the shared tax base than they would if it was taxed by only one level of government.

Wrede (2000) examines the equilibrium tax rates and expenditure levels with a model based on a Nash game, in which both inter- and intra-jurisdictional competition exists. In the model, federal and state governments share both the tax base and expenditures on public services and both of them are modeled as Leviathan maximizers of surplus, which is defined as the difference between revenue and expenditure. Wrede finds that equilibrium tax rates are higher than the coordinated case, but the expenditure levels can be either higher or lower than the coordinated case.

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13. This strand of theoretical analyses can be regarded as the extension of theoretical analyses on inter-jurisdictional competition incorporating intra-jurisdictional interaction between different tiers of government.

Flochel and Madies (2002) analyze inter-jurisdictional tax competition and vertical interaction simultaneously. They model both federal and state governments as revenue maximizing Leviathans. When only intra-jurisdictional competition exists, they find that the combined tax rate of federal and state governments is higher than the tax rate of a single government, and that the equilibrium tax rate is higher in the Stackelberg game than in Nash game. When both inter- and intra-jurisdictional competition are considered, they find that inter-jurisdictional competition lowers combined tax rates compared to uncompetitive case, but an increase in the number of states results in higher combined tax rates.

Keen and Kotsogiannis (2002) investigate the interrelationship between inter-and intra-jurisdictional competition. They incorporate intra-jurisdictional competition between federal and states into the standard tax competition model of Zodrow and Mieszkowski (1986). Keen and Kotsogiannis (2002, p.369) suggest that equilibrium tax rates depend on the dominance between the vertical externality and the horizontal externality, and that the former dominates if “the aggregate tax base is sufficiently responsive to the state tax instrument” and the latter dominates if “the interstate mobility of tax base is great enough.” Keen and Kotsogiannis (2003) examine equilibrium tax rates and the impact of intensified inter-jurisdictional competition on tax revenues using their former model (2002) with a Leviathan model of government. They show that intensifying inter-jurisdictional competition by increasing number of states increases combined tax revenues.

C. Equilibrium Analyses of Non-Hierarchical Cases

The equilibrium analyses mentioned above have focused on intra-jurisdictional competition in a hierarchy of governments, especially between the federal and state governments in the U.S. context. The intra-jurisdictional competition can also occur between political jurisdictions that have effectively co-equal taxing powers, share the same jurisdiction, and occupy the same tax base. Therefore, in this non-hierarchical case, citizens and other resources are not mobile and there is no inter-jurisdictional competition.

Beck (1993) was the first to examine the consequences of intra-jurisdictional competition in a non-hierarchical case. With a Nash game framework, Beck analyzes equilibrium tax levels of two overlapping revenue maximizing governments, a municipality and a school district. Beck finds that the tax rate set by the single government is less than the combined tax rate of the overlapping governments, and the single government's revenues are greater than the combined revenues of the two overlapping governments. This result confirms Flowers' (1988) conclusion that the combined tax rate of two revenue-maximizing governments sharing the same tax base exceeds the revenue-maximizing rate.

With a Nash game framework and a benevolent model of government, Wagoner (1995) examines the competition between political jurisdictions that occupy the same physical space and share the same tax base. In particular, Wagoner compares equilibrium tax rate and public good provision levels under two different assumptions on the government behavior, a "myopic behavior" and a non-myopic behavior. In the case of tax base sharing, each government may or may not consider the impact of its decision on the overall tax burden and on the tax revenue of the other governments. Wagoner refers to the latter case as the myopic behavior. Wagoner demonstrates that, in both cases, intra-jurisdictional competition leads to super-optimal tax rates and over-provision of public goods, and that tax rates and public good provision levels are higher in the myopic case than in the non-myopic case.

Klick and Parisi (2005) investigate intra-jurisdictional competition among multiple co-equal taxing authorities that share the same tax base within a Nash game framework and a Leviathan model of government. They show that when there are relatively a large number of taxing authorities, each has incentive to ignore the effect of raising its tax rate on the tax revenue of the other taxing authorities, generating aggregate tax rates that are higher than the tax rate of a unified tax authority. In addition, they demonstrate that the equilibrium tax rate declines as the number of taxing authorities increases until a sufficiently large number of taxing authorities are present.

D. Summary of Theoretical Analyses

The theoretical analysis on intra-jurisdictional competition has examined vertical externality which arises from co-occupancy of tax bases among multiple governments. Two main aspects of the theoretical analysis are the sign of interdependency between federal and regional tax rates and the equilibrium levels of taxation. The theoretical analysis on the interdependency in tax rates explores how the lower level of governments react to a change in tax rate of the higher level of government. It is shown that the sign of reaction of the lower level of governments is theoretically ambiguous.

The theoretical analysis on the equilibrium levels of taxation generally shows that an increase in taxes by one level of government results in a reduction in revenue to the other level. This negative vertical externality causes one level of government to underestimate the social marginal cost of raising tax revenue from the common tax base, since it ignores its impact on others of choosing its tax rate. This, in turn, makes both levels of government set a higher total tax rate on the shared tax base than they would if it was only taxed by one level of government or coordinated case. Some formal theoretical analyses also investigate intra-jurisdictional competition in non-hierarchical case. Consistent with the results of hierarchical cases, their results generally show that the intra-jurisdictional competition leads to a super-optimal tax rate and over-provision of public goods because each government underestimates the true social cost of any proposed tax increase.

On the other hand, when vertical and horizontal externalities are at work in a federation at the same time, they generally distort levels of taxation in opposite directions. The theoretical analysis shows that vertical fiscal externalities provide an incentive for lower levels of governments to set their tax rates too high, while horizontal fiscal externalities provide the opposite incentive. An interesting prediction is that intensifying inter-jurisdictional competition, by increasing the number of lower level governments, leads to lower combined tax rates (Flochel and Madies, 2002) but to higher combined tax revenues (Flochel and Madies, 2002; Keen and Kotsogiannis, 2003). This is because while an increase in the number of local jurisdictions leads to a decrease in local tax rates, the federal government reacts by increasing its own tax rate, but by less than the increase of the local tax rate.

There are two primary empirical predictions drawn from the theoretical analysis of intra-jurisdictional competition. The first clear empirical prediction is to do with the existence of interdependency in tax rates between governments sharing the same tax base. Theoretical analyses provide four possible effects influencing the direction of a government's response to a change in the tax rate of the other government: the revenue effect, the expenditure effect, the tax substitutability and complementarity effect, and the deadweight loss effect. Theoretical analyses show that the revenue effect is positive, the expenditure effect is negative, and the other two effects are ambiguous. Therefore, the sign of the reaction is theoretically ambiguous and it can only be determined empirically.

Second, regardless of whether the relationship between governments is hierarchical or co-equal and whether the analytical framework is the Nash or the Stackelberg game, all of the theoretical analyses predict that intra-jurisdictional competition leads to a higher combined tax rate than that of a unitary or a coordinated case. The theoretical rationale for this prediction is that, when multiple governments share the same tax base, each government ignores or underestimates the negative impact of an increase in its tax rate on the tax base and on the tax revenue of the other governments and, consequently, this ignorance or underestimation of the negative externality leads to a higher combined tax rate.

2-5-2. Empirical Evidence of Intra-jurisdictional Competition

Compared to the inter-jurisdictional competition studies and to the theoretical analysis on vertical interaction, very few studies have recently started to empirically examine the vertical interaction issues. As shown above, theoretical analyses have focused on the efficiency implication of vertical interaction which is assumed to occur when different levels of governments co-occupy the same tax base. However, empirical studies have concentrated on the presence of vertical interaction by estimating the lower level of governments' reactions to the policy changes of the higher level of government.

The presence of vertical interaction is examined by testing the statistical significance of the coefficient on the higher level of government's tax policy because the sign of the reaction is theoretically ambiguous as shown in the theoretical literature review. These studies can be grouped into two types. While one type of studies examines exclusively the vertical interaction, the other type of studies investigates both the horizontal and the vertical interactions simultaneously. These empirical studies on the vertical interaction are summarized in Table 2-4.

A. Intra-jurisdictional Competition

Early empirical studies on the vertical interaction in taxation between different levels of governments ignore the possibility of horizontal competition among the lower level of governments. These early studies may suffer from the omitted variable bias, which leads to biased results, ignoring the horizontal competition. Only two studies, Besely and Rosen (1998) and Goodspeed (2000), are reviewed and their results are contradictory. While Besely and Rosen (1998) find a positive reaction of states to federal excise tax rates, Goodspeed (2000) finds a negative reaction of local governments to the central or federal income tax revenues.

Besley and Rosen (1998) perform one of the first empirical tests for the intra-jurisdictional or vertical interaction between different levels of government. They examine the reaction of U.S. continental states to changes in federal excise taxes on cigarettes and gasoline for the period 1975-1989. They find that changes in federal excise tax rates on cigarettes and gasoline have positive and statistically significant effects on the corresponding state tax rates, confirming the vertical interaction hypothesis. They also find that increases in the federal cigarette tax rate induce the states to increase their general sales tax rates. Based on the above results, they suggest that federal systems may be susceptible to a “tragedy of the commons” in which non-cooperative tax setting between different levels of government leads to excessive taxation of common tax bases (p.397).

Goodspeed (2000) investigates vertical interaction in income tax revenues between the central or federal and local government, based on panel data of 13 OECD countries for the period 1975-1984. He controls for horizontal tax competition by introducing a proxy for tax base mobility, a poverty index, in a local income tax revenue equation. He finds that an increase in central or federal income tax revenues induces local governments to lower their income tax revenues. Regardless of whether or not the poverty index is appropriate as a proxy for the measure of horizontal competition, he also finds that lower poverty rates, which indicate a high degree of horizontal competition, lead to lower income tax revenues of local governments.

B. Intra- and Inter-jurisdictional Competition

The recent empirical studies examine the vertical interaction in various tax policies between different layers of government, controlling for the horizontal competition among the lower level of governments. As the empirical literature on tax competition and yardstick competition has demonstrated, it is highly likely that governments compete with each other through taxations. While considering both horizontal and vertical interaction may complicate the analysis, it is surely helpful to identify the direction and the size of the vertical interaction. The empirical studies reviewed below test the robustness of the previous empirical results and generalize it by allowing for horizontal competition.

Esteller-Moré and Solé-Ollé (2001) examine the reaction of state personal income and the combined income and general sales taxes to federal personal income tax changes using panel data of 41 U.S. states for the period 1979-1996. They control for horizontal competition by including the average tax rates of competing states, which is defined by the contiguity criterion, in the state reaction functions. They find that increases in the federal income tax rate have positive and significant impacts both on state income tax rates and on the combined income plus general sales tax rates, indicating the positive reaction of state income and combined income plus sales tax rates to the federal income tax rate changes. They also find that the coefficient on competing states' income tax rates is positive and significant, confirming the presence of horizontal competition among states in setting income tax rates.

Hayashi and Boadway (2001) analyze vertical interaction in business income tax rate setting by federal and provincial governments using panel data of Canada for the period 1963-1996. They estimate separate tax rate setting equations, which also allow horizontal competition among provinces, for the federal government, Ontario, Quebec, and an aggregate of the remaining other eight provinces. They find some evidence of significant vertical and horizontal interactions in the setting of business income tax rates. The results show that the federal tax rate has negative effects on Quebec's and the eight provinces' tax rates, while Ontario's tax rate is not significantly affected by the federal tax rate. This, in general, indicates negative responses of provincial tax rates to the federal tax rate. Their results also confirm the presence of horizontal competition among the provinces. Ontario's tax rate has a significant positive effect on Quebec's and the eight provinces' tax rates, although all other horizontal competitions are not significant.

Brülhart and Jametti (2006) examine the presence of both horizontal and vertical competition and the dominance between them, using a panel data set for 38 Swiss municipalities. Based on Keen and Kotsogiannis's (2002) theoretical prediction, they derive a dominance hypothesis that smallness leads to lower tax rates if the horizontal competition dominates, but it leads to higher tax rates if the vertical competition dominates. In the model, the dependent variable is a tax index calculated using 9 taxes and the smallness is measured by subtracting the municipality's share of cantonal population from unity. Their results show that the coefficient on smallness is positive and statistically significant. This supports the vertical competition dominance hypothesis that municipalities accounting for a smaller share of the cantonal population have higher tax indices. They also provide evidence for the presence of both horizontal competition among municipalities and vertical interaction between municipalities and cantons, showing that the competitor's tax indices have positive and significant effects on the tax index and the coefficients on the cantonal tax index are positive and significant.

Devereux, Lockwood, and Redoano (2007) extend Besley and Rosen's (1998) study by allowing for horizontal competition among states and, consequently, test the robustness of Besley and Rosen's (1998) results. They estimate separate state reaction functions for cigarette and gasoline taxes, using panel data of 48 U.S. states for the period 1977-1997. In the reaction functions, the neighbors' tax rates, which control for horizontal competition, are measured by the simple or the population density weighted average tax rates of border sharing states, or the simple average tax rates of all other states. They find evidence of vertical interaction in gasoline taxes, especially when the neighbors' tax rates are measured by the population density weighted average of border sharing states. This confirms the results of Besley and Rosen's (1998) study in gasoline taxes but not in cigarettes taxes. They also find evidence of horizontal competition among states in cigarettes taxes, but not in gasoline taxes.

C. Summary of Empirical Studies

In general, most studies reviewed above find some statistically significant evidence of vertical interaction in various tax policies between different tiers of government. In addition, in examining the presence of horizontal competition, some empirical studies allow for vertical interactions (for example, Brett and Pinkse, 2000; Revelli, 2001; Luna, 2004; Hendrick et al., 2007). Most of these studies also provide evidence of vertical interaction, finding a statistically significant reaction of the lower level of governments to changes in tax policies of the higher level of government.

However, the direction of the vertical interaction is inconsistent among the empirical studies. While Besley and Rosen (1998), Luna (2004), Brülhart and Jametti (2006), Devereux et al. (2007), and Hendrick et al. (2007) find a positive reaction of the lower level of governments to a change in tax policies of the higher level of government, Brett and Pinkse (2000), Goodspeed (2000), and Hayashi and Boadway (2001) find contrasting results. These contrasting results of the sign of the reaction are consistent with the theoretical ambiguity of the direction. However, it may also reflect differences in analytical methods, taxes analyzed, and institutional relations between different levels of government.

Several empirical studies confirm the simultaneous existence of vertical and horizontal competition in setting tax policies (for example, Esteller-Moré and Solé-Ollé, 2001; Hayashi and Boadway, 2001; Luna, 2004; Brülhart and Jametti, 2006). The presence of both horizontal and vertical interaction implies that the tax policy of a government is affected not only by competing governments' tax policies but also by the tax policy of governments sharing the same tax base. Devereux et al. (2007) formally show that the addition of the spatially lagged dependent variable to control for the horizontal competition reduces the magnitude and the statistical significance of the coefficient on the higher level of government's tax policy, which measures the effect of vertical interaction. Therefore, to get robust and unbiased results, it is important to consider both horizontal and vertical interaction simultaneously.

Several empirical studies have examined the theoretical predictions of the intra-jurisdictional competition theory. However, there is still a gap between the theoretical prediction and the empirical understanding. First, the efficiency implication of vertical interaction remains empirically untouched. Theoretical analysis has concentrated on the efficiency implications by comparing the equilibrium tax levels of overlapping governments with those of unitary or coordinated cases. However, empirical studies on vertical interaction have explored exclusively the interdependency in setting tax policies between different levels of government.

Second, there is no empirical study on the interaction in tax policies between effectively co-equal taxing authorities, which share the same tax base. In the U.S, for instance, school districts and municipalities share the same tax base and independently set tax rates without any kind of hierarchical structure. However, in the U.S. context, empirical studies have focused on the vertical competition in tax policies among hierarchically nested governments, especially between states and the federal government. Solving these two untouched issues can enhance our understanding of how governments interact or compete and what are the consequences in a federal or multi-level structure of government.

Table 2-4. Summary of Empirical Studies on Intra-jurisdictional Competition

Study	Unit of Analysis	Neighbors [1]	Method [2]	Dependent Variable	Horizontal / Vertical Interaction [3]	Findings of Interaction [4]
I. Intra-Jurisdictional Competition						
Besley & Rosen (1998)	State, US (1975-1989)		FE	Cigarette tax rate Gasoline tax rate	Federal cigarette tax rate Federal gasoline tax rate	Positive Positive
Goodspeed (2000)	OECD Country (1975-1984)		Tobit (FE)	Local income tax rate	National income tax rate Poverty index	Negative Positive
II. Intra- and Inter-jurisdictional Competition						
Esteller-Moré & Solé-Ollé (2001)	State, US (1987-1996)	Contiguity	IV (FE)	Income tax rate Income & Sales tax rate	Federal income tax rate Wy Federal income & sales tax rate Wy	Positive Positive Positive Positive (NS)
Hayashi & Boadway (2001)	Province, Canada (1963-1996)	Uniform	SUR (IFGLS)	Income tax rate	Federal income tax rate Wy	Negative Positive
Brülhart & Jametti (2006)	Municipality, Swiss (1985-2001)	Municipalities in the same Canton	IV	Tax index (income, wealth, capital)	Cantonal tax index Wy by Canton Fragmentation	Positive Positive Positive
Devereux et al (2007)	State, US (1977-1997)	Uniform (U) Contiguity (C) Neighbor density (D)	IV	Cigarette tax rate Gasoline tax rate	Federal cigarette tax rate Wy Federal gasoline tax rate Wy	Positive (NS) Positive (NS with U) Positive (NS with D) Positive (NS with U, C), Negative (NS with D)

1. SMSA-Standard metropolitan statistical area and Uniform-All other provinces or states.
2. FE-Fixed effects, IFGLS-Iterated feasible generalized least squares, IV-Instrumental variables, and SUR-Seemingly unrelated regression.
3. Wy-Spatially lagged dependent variable (Average of neighbors' dependent variable).
4. NS-Not significant at the conventional confidence levels.

2-6. Conclusion

This chapter has reviewed theoretical and empirical studies that examined the existence of fiscal competition among governments and its effects on government performance. Through the literature review, it is concluded that there are both theoretical and empirical reasons to believe that local governments engage in fiscal competition. However, the literature offers no precise conclusion on the mechanism under which such fiscal competition occurs and on the effect of competition on government performance.

2-6-1. Summary of Theories on Government Competition

The four theories on inter-jurisdictional competition and the intra-jurisdictional competition theory have different views on the mechanism in which competition arises and the effect of competition on government performance, especially in terms of efficiency. Table 2-5 summarizes the source of, tools for, and effects of inter- and intra-jurisdictional competition by theory.

Table 2-5. Summary of Alternative Theories on Competition among Governments

Theory	Inter-jurisdictional Competition				Intra-Jurisdictional Competition
	Tiebout (1956)	Tax competition	Leviathan hypothesis	Yardstick competition	
Tools for competition	Head taxes and expenditures	Capital taxes	Taxes and expenditures	Taxes and expenditures	Taxes and expenditures
Source of competition	Mobility of citizen	Mobility of capital	Mobility of citizen	Citizens' relative performance evaluation	Tax base sharing Overlapping service provision
Effect on tax rates	Negative	Negative	Negative	Negative	Positive
Effect on government size	Negative	Negative	Negative	Negative	Positive
Assumption on government	Benevolent welfare maximizer	Benevolent welfare maximizer	Self-interested budget maximizer	Budget maximizer or welfare maximizer	Budget maximizer or welfare maximizer
Effect on government efficiency	Technical efficiency Allocative efficiency	Allocative inefficiency (Underprovision of public goods)	Technical efficiency Allocative efficiency	Technical efficiency Allocative efficiency	Allocative inefficiency (Overprovision of public goods)

A. Inter-Jurisdictional Competition

The concern on inter-jurisdictional competition was initiated by Tiebout (1956), although his main concern was to find a market-like mechanism that would achieve an efficient allocation of resources in the public sector. The Tiebout model has been elaborated and extended by the tax competition and Leviathan literatures. On the other hand, yardstick competition focuses on political institutions as a source of competition which is ignored in the Tiebout, tax competition, and Leviathan literatures.

Tiebout (1956) examines a situation in which a large number of local jurisdictions exist in a metropolitan area. The core of the Tiebout model is mobility of residents. Since residents are costlessly mobile across jurisdictions, they tend to choose the jurisdiction that offers them the best combination of public goods and taxes to pay for them. Tiebout concludes that public goods and services provided by the local government exhibit both allocative efficiency and technical efficiency. Although the process of competition in the Tiebout model has been labeled 'voting with one's feet', there is actually no politics involved.

Oates (1972) counters Tiebout (1956) by arguing that attempts by local governments to attract business investment may lead to inefficiently low levels of local public goods. This reasoning has been formalized by Zodrow and Mieszkowski (1986), Wilson (1986), and many subsequent studies. In contrast to Tiebout's model, tax competition models assume that, instead of a non-distortionary head tax, public services must be financed by a property tax defined as a tax on mobile capital, residents are immobile, and their preferences are homogeneous between jurisdictions. In general, formal theoretical analyses confirm Oates's (1972) argument, demonstrating that inter-jurisdictional tax competition leads to sub-optimal tax rates and, thus, to under-provision of public goods.

The Leviathan hypothesis extends the Tiebout model by combining the inter-jurisdictional competition induced by citizen mobility in the Tiebout model with Niskanen's (1971) budget maximizing bureaucrats thesis. Brennan and Buchanan (1980) argue that competition among jurisdictions serves as a powerful constraint on the undesirable expansionary tendencies of the public sector. Subsequent formal theoretical analyses, in general, confirm the Brennan and Buchanan's Leviathan hypothesis, showing that inter-jurisdictional competition for a mobile tax base can enhance technical efficiency in local public goods provision by reducing government's rent-seeking behavior.

Salmon (1987) extends the retrospective voting model developed in political science into a yardstick competition theory by adding the concept of relative performance evaluation from labor economics. The main idea of yardstick competition is that citizen-voters can make self-interested politicians responsive and accountable to the public interest by using relative performance evaluations in repeated elections. With various political agency models, formal theoretical models verify Salmon's idea, showing that yardstick competition can constrain incumbents' rent-seeking behaviors. One virtue of the yardstick competition model is that it is a complement to the dominant economic approaches to the inter-jurisdictional competition, the Tiebout, tax competition, and Leviathan models.

In terms of the channel in which governments compete with each other, Tiebout, Leviathan hypothesis, and tax competition models are based on the mobility of residents, goods, or factors of production, while yardstick competition arises through the fact that citizen-voters comparatively evaluate the performance of politicians and base their vote on this comparative performance evaluation in an election. The relationship between yardstick competition and the mobility based competition can be understood by the concept of "exit" and "voice" developed by Hirschman (1970).

Trade-offs may exist between exit and voice. For instance, if exit is easy, then this may undermine any incentive for residents to engage in the voice mechanism. On the other hand, exit and voice may be complementary rather than competing mechanisms. For example, the ultimate sanction of exit can increase the effectiveness of voice. Threats of exit may strengthen rather than weaken voice and policy measures facilitating exit can enhance the credibility of these threats (Dollery and Wallis, 2001). However, the Tiebout, tax competition, and Leviathan models ignore the voice mechanism, and the exit mechanism is absent in the yardstick competition model.

In terms of the effects of competition, all four theories predict that governments consider other governments' policies in setting its policies, and that inter-jurisdictional competition reduces tax rates, tax revenue, and the provision of public goods and services. However, the theories have different views on efficiency implication of inter-jurisdictional competition. While Tiebout, Leviathan hypothesis, and yardstick competition models view the reduced tax rate, tax revenue, and public spending as the elimination of waste, the tax competition model regards those as the loss of welfare.

These contrasting views on the effect of competition on government efficiency reflect different assumptions about government behavior and about the taxes used to finance public goods. In terms of allocative efficiency, while Tiebout argues that competition encourages governments to allocate resource efficiently, the tax competition literature suggests that competition for mobile capital leads to allocative inefficiency. The difference in the consequences of inter-jurisdictional competition between the Tiebout and tax competition models is due to the different taxes used to finance public goods. While Tiebout assumes that local governments use a non-distortionary head tax to finance public services, tax competition models assume that a distortionary tax on mobile capital is used to provide public goods.

The tax competition model and other theories on inter-jurisdictional competition, in fact, deal with two different aspects of government efficiency. While the tax competition models examine the effect of inter-jurisdictional competition in terms of allocative efficiency, the Leviathan hypothesis and yardstick competition literatures focus on technical efficiency. By assuming that the government is a benevolent maximizer of citizens' welfare and the production technique of the government is identical across jurisdictions, the tax competition model eliminates technical inefficiency issues and focuses only on the allocative efficiency implication of inter-jurisdictional competition. On the other hand, assuming that the government is a self-interested revenue maximizer, the Leviathan hypothesis and yardstick competition models investigate the result of inter-jurisdictional competition in terms of technical inefficiency or X-inefficiency, which is defined as government rent, waste, or managerial slack in formal theoretical models.

B. Intra-jurisdictional Competition

In a multi-level government structure, fiscal competition can occur between different levels of government or between different types of government. On the revenue side of the budget, intra-jurisdictional competition takes place due to the co-occupancy of the same tax base among multiple governments. Theoretical analyses have explored two issues of intra-jurisdictional competition: interdependency in tax policies among governments and equilibrium levels of taxation.

A few theoretical analyses on the interdependency in tax policies have investigated how a government reacts to a change in the tax rate of the other government. Theoretical analyses provide four effects affecting the direction of a government's reaction to the other government's tax rate change: the revenue effect, the expenditure effect, the tax substitutability and complementarity effect, and the deadweight loss effect. Theoretical analyses show that the former two effects are in opposite directions and the directions of the latter two effects are ambiguous. Therefore, it is concluded that the sign of the reaction is theoretically ambiguous.

On the other hand, a large number of formal theoretical analyses on the equilibrium levels of taxation have focused on what are the consequences of intra-jurisdictional competition. In particular, these studies have explored the allocative efficiency implication of intra-jurisdictional competition by comparing the equilibrium tax levels of overlapping governments with those of unitary or coordinated cases. Both in a hierarchical case and in a co-equal case, the formal theoretical analyses demonstrate that intra-jurisdictional competition results in super-optimal taxation and over-provision of public goods because each government ignores or underestimates the negative impact of raising its tax rate on the tax base and on the tax revenue of the other governments.

2-6-3. Empirical Evidence of Inter- and Intra-jurisdictional Competition

Regardless of underlying theories, empirical studies on the inter-jurisdictional competition can be categorized into two strands: studies on the presence of competition and studies on the effect of competition. The former has focused on investigating the existence and magnitude of inter-jurisdictional competition by employing spatial econometric techniques. The latter has examined the effect of inter-jurisdictional competition on government performance. On the other hand, empirical studies on intra-jurisdictional competition have exclusively examined the interdependency in tax rates among governments sharing the same tax base.

A. Existence of Competition

The empirical studies on the presence of inter-jurisdictional competition estimate a tax rate reaction function, which reflects the response of a given government to the tax rate changes of its neighboring governments or relevant rivals. A number of studies have presented evidence for the existence of inter-jurisdictional competition, showing that the tax rate of a government is influenced by tax rates in competing governments. However, it is not clear whether significant spatial correlation in tax rates among governments stems from mobility based competition, from yardstick competition, or both. According to Brueckner (2003), this is because the studies did not model explicitly the source of competition among governments, and, thus, the reduced-form spatial reaction function of both theories is exactly the same.

Some studies have investigated which theory is the most likely source of the correlated tax rates across neighboring or competing governments. To discriminate yardstick competition from mobility based competition, several studies test a link between the spatial correlation in tax rates across jurisdictions and the electoral system or electoral results. On the other hand, to validate mobility based competition, some studies examine the effect of own and neighbors' tax rates on the tax base. Both the yardstick competition and mobility based competition are empirically demonstrated as the sources of fiscal competition among local governments. However, the validity of yardstick competition does not eliminate the possibility that the mobility based mechanism induces local governments to compete with each other, and vice versa.

While formal theoretical analyses on intra-jurisdictional competition have focused on the allocative efficiency implication, empirical studies have examined exclusively the interdependency in tax rates among governments sharing the same tax base. These empirical studies have explored various taxes, such as income, property, sales, and excise taxes. As theoretical analyses predict, empirical studies show inconsistent signs of a government's reaction to the tax rate change of the other government. More recent empirical studies examine inter-and intra-jurisdictional competition simultaneously, while focusing on one of them. These studies, in general, show that both inter- and intra-jurisdictional competition takes place.

B. Effect of Competition

The two aspects of government performance that have been studied in the context of inter-jurisdictional competition are public sector size and government efficiency. The four theoretical models of inter-jurisdictional competition have in common a prediction that inter-jurisdictional competition reduces the government size, which is usually measured by revenues or expenditures. However, as shown above, the four theories of inter-jurisdictional competition have contrasting views on the effect of competition on government efficiency. Therefore, it is an empirical question whether inter-jurisdictional competition is beneficial or not, in terms of government efficiency.

A large number of empirical studies have examined the relationship between the degree of inter-jurisdictional competition and the public sector size or individual government size. The results of these studies are best described as inconsistent. There seems to be a distinction between general-purpose governments and special-purpose governments. Studies suggest that competition among general-purpose governments reduces the size of the aggregate public sector, while competition among special-purpose governments increases it. On the other hand, two studies on individual government size provide contrasting results.

Only a few studies have formally examined the relationship between government efficiency and the intensity of inter-jurisdictional competition. Some studies use property values to examine the allocative efficiency implication of inter-jurisdictional competition, while others explore the effect of competition on government's technical efficiency. These empirical studies find that local governments facing competitive pressure use their resources in a more technically and allocatively efficient way than local governments facing less competition. These results support the optimistic view of Tiebout, Leviathan hypothesis, and yardstick competition on inter-jurisdictional competition, while rejecting the tax competition's harmful view of it. However, the evidence is not enough to draw a general and definitive conclusion.

C. Issues in Empirical Studies

The literature suffers from several weaknesses that make it difficult to draw firm conclusions from the reviewed empirical studies. First, the literature lacks a consistent definition of the public market in which local governments compete with each other. Empirical studies on the existence of competition generally define the public market as one which varies by the government using contiguity or distance criteria. On the other hand, the empirical study on the effect of competition defines public markets as fixed geographic boundaries such as counties, SMSAs, states or provinces, and countries.

Second, while the theoretical arguments concern the impact of inter-jurisdictional competition on government performance in terms of efficiency, empirical studies have focused not on efficiency but on public sector size or government size measured by revenues and expenditures. Third, many empirical studies on the effect of competition measure competition by the total number of governments in a defined public market, assuming that all of them compete with each other. However, municipalities do not compete with counties for residents, nor do special districts compete with municipalities and/or counties. The results of these studies are especially difficult to interpret because the net effect of competition is the sum of horizontal and vertical effects. Fourth, most studies on the effect of competition either appeal to theories of inter-jurisdictional competition or presume such competition exists rather than empirically examine the existence of competition.

Chapter III. Structure and Budget Process of Local Governments in New Jersey

This chapter provides a broad overview of how New Jersey local governments are organized, what services they provide, and how they are financed. Governmental structure for providing local public services and goods varies not only by state but also differs within a state. Patterns of development and institutional arrangements for providing public services within regions evolved historically. The first section of this chapter examines the governmental structure for providing local public goods and services. The types of local governments, functions and decision-making framework of each type of local government are examined.

The second section outlines the budget process of local governments in New Jersey and analyzes what services local governments provide and how they are financed. State law requires that local budgets be balanced, making the local budget process largely revenue-driven. Among the various revenue sources, local governments in New Jersey have relied heavily on the property tax to finance local public services. Therefore, the third section is devoted to property tax administration because of its importance in financing local public goods and services.

3-1. Structure of Local Governments

The State of New Jersey has four types of local government: the county, the municipality, the school district, and the special district.[14] All types of local government are considered "creatures of the state" (Benecke, 2004a). This means that local

14. Local governments are commonly divided into two broad types: general-purpose and special-purpose governments. While general-purpose governments coordinate functions and provide a wider diversity of services, the special-purpose government provides a single public service. In New Jersey, general-purpose governments include counties and municipalities, and school districts and special districts are considered as special-purpose governments.

governments are created, altered, and abolished by state law. There is no inherent local authority to create these government entities. With minor exceptions the number of counties and municipalities do not change regularly. Only a few municipalities and school districts have been created or consolidated since 1930.

3-1-1. County Governments

In New Jersey, there are 21 counties and no areas in the state lie outside the jurisdiction of a county government. In 1776, there were 13 counties in New Jersey. Since then, counties have been subdivided until Union, the last county of the present 21 counties, was formed in 1857 (Benecke, 2004a). Although county governments in New Jersey perform a broad range of functions such as elections, judicial systems, emergency, and public health, among other services, there has been a lack of interest and knowledge concerning the county government. This is partly because the taxpayer has paid no tax directly to the county but to the municipality, which passes it on, and partly because the county has been recognized as the administrative arm of the state government for implementing its policies on a local level.

A. Functions of County Governments

County governments in New Jersey provide a broad range of services. The number and scope of county services vary across the state. While all counties are required to perform certain functions such as elections, judicial systems, and county jail, many other functions are optional. The required services are an extension of the state government when counties are the fiscal and administrative agents exercising political, executive, and judicial powers.

As such, counties have been considered as creatures of the state and functioned primarily to serve the will of the state in providing services to its citizens. In fact, many state programs are administered in cooperation with county governments. In addition to the required services by the state government, counties may operate many programs such as police and fire training academies and emergency services, maintain park and recreation systems, and administer programs for public health functions.

B. Board of Chosen Freeholders

In New Jersey, the governing body of counties is referred to as the board of chosen freeholders. This system of naming the county governing body the freeholders is unique in the United States. The origin of the term was in the provisions of the New Jersey State Constitution of 1776.[15] Freeholders are the backbone of the county government. They are elected county government representatives who serve on the county's main governing body. They play the central role in the formulations, adoption, and implementation of county policy. They exercise both legislative and administrative powers. They enact the annual county budget under their legislative power and expend some of the monies appropriated in the budget under their administrative authority.

The structure of governing body available to counties is prescribed by state statutes enacted at various times during the state's history. Now, five different governmental structures are available to counties: a traditional structure and four optional plans of county government. The traditional form of county government is prescribed by

15. The New Jersey Constitution of 1776 stated that "That all inhabitants of this Colony, of full age, who are worth fifty pounds proclamation money, clear estate in the same, and have resided within the county in which they claim a vote for twelve months immediately preceding the election, shall be entitled to vote for Representatives in Council and Assembly; and also for all other public officers, that shall be elected by the people of the county at large." The logical designation of such officeholders would be "Chosen Freeholders" because property in "clear estate" is known as a freehold.

a multitude of statutes dating back many years which authorize the board of chosen freeholders as the general governing body of the county (Benecke, 2004a). Under this traditional form, the board of chosen freeholders consists of three to nine members, elected at large for three-year terms of office on a staggered basis. The chosen freeholders generally serve both as members of the policy-making board and also as individual administrators of county departments.

The Optional County Charter Law (OCCL) of 1972 (N.J.S.A. 40:41A-2 et seq.) authorized voters of any county to replace the traditional form of county government with one of four different plans of county government: county executive plan, county manager plan, county supervisor plan, and board president plan.[16] The county executive plan has an elected county executive who appoints a county administrator as well as heads of county boards and commissions with the advice and consent of the elected freeholder board. The county manager plan has a county manager appointed by the elected freeholders as a chief executive and administrative official. The county manager appoints and removes department heads, negotiates contracts, prepares the budget, and advises the board of freeholders. The county supervisor plan has a county administrator appointed by the elected freeholder board. The county administrator's work is supervised by an elected county supervisor. The board president plan has a county administrator appointed by the elected freeholder board. The board selects one of its own members as president to supervise the work of the county administrator.

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16. A resolution for changing the structure of county government may be authorized either by the board of chosen freeholders or by petition by 10% of the registered voters in a county to elect 7 members of an 11-member charter study commission. After nine months, the commission must present its findings (N.J.S.A. 40:41A-2 et seq.).

The county supervisor and the board president plans are variations which give greater authority to the board of freeholders over administrative matters. All optional plans allow a freeholder board of five, seven, or nine members elected at large, by districts, or a combination of the two with concurrent or staggered three-year terms. All optional plans provide the voters with procedures for initiative, referendum, and recall of elected officials. Currently, Union County has a county manager system, Atlantic, Bergen, Essex, Hudson, and Mercer Counties have chosen a county executive plan, and all remaining counties have the board president plan. The county supervisor plan, which merges the county executive and the county manager plans, is not currently in use.

C. Elected Constitutional Officers and Other Appointed Officers

Several elected and state-appointed county officials share county functions with the board of chosen freeholders. In every county, certain county functions are administered by these constitutional officers or appointed officers, rather than the board of chosen freeholders. Each county has three elected constitutional officers: the sheriff, the county clerk, and the surrogate. The sheriff is elected for a three-year term of office, is responsible for operation of the courts, and may operate the county jail. The county clerk is elected for a five-year term of office and responsible for election materials, county records, registering deeds, and processing applications for passports and naturalization papers. The surrogate is also elected for a five-year term of office. The surrogate probates wills, supervises minors' trust accounts, handles incompetency filings, and rules on administrative matters in uncontested probates and guardianships.

Other state-appointed county officers, who play important roles in county government, are the county superintendent of schools, the county prosecutor, and the board of elections. The county superintendent of schools is appointed by and responsible to the state commissioner of education, and monitors the public school laws and expenditure of state school aid. The county prosecutor appointed by the governor is the chief criminal law enforcement officer in a county. The board of elections is composed of two Democrats and two Republicans appointed by the governor. It supervises voter registration, keeps records of eligible voters, provides voting machines, and settles certain controversies having to do with elections.

D. County Classification

In New Jersey, counties are grouped into six classes. In an effort to recognize similarities and differences, the founders of the State Constitution set the criteria for classifying counties by state statute (N.J.S.A. 40A:6-1). Table 3-1 shows the county classification system. According to the criteria ascertained by the most recent decennial census, counties in New Jersey are categorized into six classes based on population, population density, and geographic location. The population requirements have been amended to reflect changes in population. Based on the 2000 Census and amended criteria in 2002, the class of each county, with population and population density, is shown in the last column of Table 3-2.

Table 3-1. County Classification Criteria

Class	Population	Location
I	Over 550,000 with a density of over 3,000 persons per square mile	Any part of state
II	All other counties over 200,000	Not bordering on Atlantic Ocean
III	50,000-200,000	Not bordering on Atlantic Ocean
IV	Less than 50,000	Not bordering on Atlantic Ocean
V	Over 125,000	Bordering on Atlantic Ocean
VI	125,000 or less	Bordering on Atlantic Ocean

Source: N.J.S.A. 40A:6-1.

Table 3-2. Governmental Structure and Classification of the County

Name	Form of Government	Elected Officials	Land Area	Population		Population Density		County Classification
				2000	2007	2000	2007	
Atlantic	OCCL-County Executive Plan	County executive 9 Freeholders	561.1	252,552	270,644	450.1	482.4	V
Bergen	OCCL-County Executive Plan	County executive 7 Freeholders	234.2	884,118	895,744	3,775.5	3825.2	I
Burlington	Board of Chosen Freeholders	5 Freeholders	804.6	423,391	446,817	526.2	555.3	II
Camden	Board of Chosen Freeholders	7 Freeholders	222.3	508,932	513,769	2,289.4	2311.2	II
Cape May	Board of Chosen Freeholders	5 Freeholders	255.2	102,326	96,422	401.0	377.9	VI
Cumberland	Board of Chosen Freeholders	7 Freeholders	489.3	146,438	155,544	299.3	317.9	III
Essex	OCCL-County Executive Plan	County executive 9 Freeholders	126.3	792,305	776,087	6,274.8	6146.4	I
Gloucester	Board of Chosen Freeholders	7 Freeholders	324.7	254,673	285,753	784.3	880.0	II
Hudson	OCCL-County Executive Plan	County executive 9 Freeholders	46.7	608,975	598,160	13,043.6	12812.0	I
Hunterdon	Board of Chosen Freeholders	5 Freeholders	429.9	121,989	129,348	283.7	300.8	III
Mercer	OCCL-County Executive Plan	County executive 7 Freeholders	225.9	350,761	365,449	1,552.5	1617.5	II
Middlesex	Board of Chosen Freeholders	7 Freeholders	309.7	750,162	788,629	2,422.1	2546.3	II
Monmouth	Board of Chosen Freeholders	5 Freeholders	471.9	615,301	642,030	1,303.8	1360.4	V
Morris	Board of Chosen Freeholders	7 Freeholders	469.0	470,212	488,475	1,002.6	1041.5	II
Ocean	Board of Chosen Freeholders	5 Freeholders	636.3	510,916	565,493	803.0	888.8	V
Passaic	Board of Chosen Freeholders	7 Freeholders	185.3	490,377	492,115	2,646.5	2655.9	III
Salem	Board of Chosen Freeholders	7 Freeholders	337.9	64,285	66,016	190.3	195.4	III
Somerset	Board of Chosen Freeholders	5 Freeholders	304.7	297,490	323,552	976.4	1061.9	II
Sussex	Board of Chosen Freeholders	5 Freeholders	521.3	144,170	151,478	276.6	290.6	III
Union	OCCL-County Executive Plan	9 Freeholders	103.3	522,541	524,658	5,059.0	5079.5	II
Warren	Board of Chosen Freeholders	5 Freeholders	357.9	102,433	109,737	286.2	306.6	III

Source: New Jersey Department of Labor and Workforce Development (2000, 2007) - land area, population, and population density; Center for Government Services (2006) - form of government and elected officials.

3-1-2. Municipal Governments

Municipalities in New Jersey are independent local government units having authority to provide many public services immediately consumed by residents such as police and fire protection, streets, sanitation facilities, and so on. Currently, 566 municipalities operate in New Jersey. In 1930, there were 559 municipalities. Since 1930, only 10 new municipalities were created and 3 municipalities were eliminated. In 1951, Landis Township and Vineland City were consolidated into Vineland Township. Loch Arbour Village, created with the population of 350 in 1957, is the last municipality created in New Jersey (Karcher, 1998). In 1997, Pahaquarry Township with population 10 was abolished.

New Jersey is the most urbanized and most densely populated of the fifty states. In terms of population density, New Jersey leads the nation with 1,171 people per square mile in 2000 and 1,181 people per square mile in 2007 (U.S. Census Bureau, 2007). The range in population and land area is dramatic. In 2007, the average estimated population of municipalities was 15,346. While Newark's estimated population was 280,135, Teterboro, Pine Valley, and Tavistock had fewer than 30 residents. The average land area of a municipality is approximately 13.1 square miles. The largest municipality is Hamilton Township with 111.3 square miles and the smallest municipality is Shrewsbury Township with 0.09 square miles.

A. Forms of Municipal Government

The differences in the governmental structures are the official positions required, their method of selection, their powers, and the relationship between the executive and legislative branches. The governmental structures now available to New Jersey municipalities reflect state statutes enacted at various times during the state's history. There are twelve different governmental structures available to New Jersey municipalities. These twelve distinct governmental structures can be identified by the type of municipality and the form of government organization.

The type of municipality refers to the official title by which the municipality is identified: city, town, borough, township, and village. In the past, the type of municipality was significant in identifying different forms of government under which the organization of municipalities operated. However, today, all types of municipalities have basically the same government authority and the type of municipality is merely a title. The statutes governing those five types of municipalities have been rewritten in recent years (Reock, 2002). These laws are city form (N.J.S.A. 40:103-5(71) and N.J.S.A. 40A:61-1 et seq.), town form (N.J.S.A. 40A:62-1 et seq.), borough form (N.J.S.A. 40A:60-1 et seq.), township form (N.J.S.A. 40A:63-1 et seq.), and village form (N.J.S.A. 40A:63-8 et seq.).

In addition to the five traditional forms, municipalities can adopt seven optional forms of government authorized by the laws enacted during the twentieth century. The first optional form of municipal government was enacted by the legislature in 1911 as the Commission Form of Government Law (N.J.S.A. 40:70-1 et seq.). In 1923, the legislature enacted the second optional law, the Municipal Manager Form of Government Law (N.J.S.A. 40:79-1 et seq.). The third law was the Optional Municipal Charter Law (OMCL), also known as the Faulkner Act, enacted in 1950. The OMCL provided for four distinct forms of municipal government: mayor-council form (1950), council-manager form (1950), small municipality form (1950), and mayor-council-administrator form (1981). Finally, since the revision of the state constitution in 1947, municipalities have been able to adopt a special charter, which provides for a unique form of government.

The two laws (N.J.S.A. 40:103-5(71) and N.J.S.A. 40A:61-1 et seq.) of the city form of government provide for a separately elected mayor and council.[17] The mayor serves as chief executive and is the head of the police department, with the power to appoint senior officers in the police department with the advice and consent of the council. The mayor has a veto over ordinances. The council is the legislative body and selects one of its own members to preside as the council president. The council makes most appointments of municipal personnel with the exception of the police department. As of January 1, 2005, these two laws were used by only 15 municipalities.

The town form of government (N.J.S.A. 40:63-1 et seq.) provides an elected mayor for a two or three year term of office and eight council members elected from four wards for two year overlapping terms. The mayor is the official head of a municipal government, presides and may vote at council meetings, and has a veto power over ordinances, which may be overridden only by a two-thirds vote of all members of the council. The council is the legislative body and makes almost all appointments. All executive powers not specifically designated for the mayor are exercised by the council. As of January 1, 2005, only 9 municipalities still used this town form.

The borough form (N.J.S.A. 40A:60-1 et seq.) is the most common among New Jersey municipalities. This form provides for a mayor and a six member council, elected

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17. A series of laws for the city form of government enacted before the early twentieth century have been repealed. Now, the law of 1963 (N.J.S.A. 40:103-5(71)) allows only East Orange to adopt the city form of government and the law of 1987 (N.J.S.A. 40A:61-1 et seq.) replaced all other city laws (Reock, 2002).

separately in partisan elections. The mayor serves for four years, while council members serve three year staggered terms of office, with two council seats being contested each year. The mayor presides at council meetings, but votes only to break ties. The mayor nominates all appointive officers subject to council confirmation. The council has all executive responsibilities not specifically assigned to the mayor. As of January 1, 2005, 218 municipalities used this borough form.

The township form (N.J.S.A. 40:63-1 et seq.) provides a township committee of three or five members elected for three year staggered terms. The township committee exercises all legislative and executive authority of the municipality. Committee members annually choose one of their own members to serve as mayor for that year. The mayor presides at committee meetings and votes as a member of the committee, but has no other special power. In general, all formal legislative and executive powers are exercised by the committee as a whole. This form is one of the oldest forms of municipal government in New Jersey and was still used by 144 municipalities as of January 1, 2005.

Under the village form (N.J.S.A. 40A:63-8 et seq.), the governing body is a non-partisan board of trustees, consisting of five members elected at large for three-year staggered terms of office. The board of trustees exercises all legislative and executive authority of the municipality. The president of the board of trustees, who is equivalent to mayor in other forms of municipal government, is selected from among the five trustees and serves a one-year term of office. As of January 1, 2005, only Loch Arbour used this form of government.

The commission form (N.J.S.A. 40:70-1 et seq.) was authorized in 1911. This form provides for the election of three or five commissioners. The commissioners collectively constitute a board, which is the legislative body of the municipality. The executive function of the municipality is divided among the three or five commissioners, each of whom is the director of one of the municipal departments specified by law. One commissioner is chosen by the board to serve for four years as the mayor and to preside over meetings of the board. This form of government is used by 32 municipalities as of January 1, 2005.

The municipal manager form (N.J.S.A. 40:79-1 et seq.) enacted in 1923 is the second of the major optional laws (Reock, 2002). Under this form of government, voters elect three, five, or nine members of a council for four-year concurrent terms of office. The council appoints a municipal manager, a tax assessor, an auditor, a treasurer, a municipal clerk, and an attorney. Thereafter, the council functions as a legislative body and administrative duties are prohibited for council members. The mayor is selected by the council from among its own members, with duties mainly limited to presiding and voting as a member in council meeting. As of January 1, 2005, only 7 municipalities use this form of government.

The OMCL mayor-council form (N.J.S.A. 40:69A-1 et seq.) provides for the election of a council, which is the legislative body of the municipality, and a mayor with strong executive and administrative powers. The mayor appoints the departmental heads, the tax assessor, and most members of boards, commissions, and authorities with the advice and consent of the council. The mayor has a veto power over ordinances, which may be overridden only by a two-thirds vote of the council. The council, which may consists of five, seven, or nine members, is limited to legislative functions. The council selects one of its members to preside, with the title of president of council. Although only

67 municipalities had adopted this form of government as of January 1, 2005, they included most of the large municipalities of New Jersey, including Newark.

Under the OMCL council-manager form (N.J.S.A. 40:69A-1 et seq.), voters elect five, seven, or nine members of a council for four-year terms of office. The council appoints most municipal officers, including a manager, a municipal clerk, and a tax assessor. After appointing the manager, the council is limited to legislative functions and must act as a body. The manager is the chief executive and either appoints all subordinate personnel not otherwise provided for or delegates the appointive power to department heads. The mayor may be selected by the council from among its own members or be elected directly by the voters. However, the mayor is little more than a presiding officer for the council. This optional form of government was used by 42 municipalities as of January 1, 2005.

The OMCL small municipality form (N.J.S.A. 40: 69A-1 et seq.) provides for a council and a mayor either elected from the council or directly by the voters. The mayor is the chief executive officer and appoints most municipal officers including an assessor, a tax collector, a municipal clerk, and a treasurer, with the advice and consent of the council. The council is the legislative body and has no specified administrative duties or appointments to make. One member of the council is chosen as the president of the council to preside in the absence of the mayor. As of January 1, 2005, only 18 municipalities were served by this form of government.

The OMCL mayor-council-administrator form (N.J.S.A. 40:69A-1 et seq.) has been available by an amendment of the OMCL in 1981. Under this form, a mayor for four-year terms of office and six members of council for three-year staggered terms of office are elected in at large partisan elections. The mayor appoints most officers including an administrator, and presides in council meetings, but votes only to break ties. The mayor also has a veto over ordinances. The administrator is directed to administer the business affairs and to supervise all of the departments. The council is the legislative body and members have no administrative duties and no appointive powers. As of January 1, 2005, only North Brunswick and West Milford used this form of government.

Table 3-3. Forms of Municipal Government in 2005

Form of Government	Number of Municipality	Land Area (Square Miles)		Population		Average Population Density	Smallest Municipality (Population)	Largest Municipality (Population)
		Total	Average	Total	Average			
Old Forms								
City	15	77.2	5.1	211,409	14,093.9	3,411.7	Corbin City (527)	East Orange (67,508)
Town	9	65.4	7.3	124,670	13,852.2	9,928.3	Clinton Town (2,588)	Kearny (38,707)
Borough	218	550.6	2.5	1,533,911	7,036.2	3,815.6	Rockleigh (393)	Sayreville (42,744)
Township	144	4,083.6	28.4	1,584,717	11,005.0	894.6	Walpack (40)	Lakewood (68,688)
Village	1	0.1	0.1	279	279.0	2,883.7	Loch Arbour (279)	Loch Arbour (279)
Optional Forms								
Commission	32	167.4	5.2	363,600	11,362.5	6,332.7	Pine Valley (22)	Union City (65,021)
Municipal Manager (1923)	7	23.6	3.4	196,836	28,119.4	8,176.2	Teterboro (18)	Clifton (78,911)
OMCL: Mayor-Council	67	1,200.8	17.9	3,170,671	47,323.5	5,067.5	Avalon (2,188)	Newark (277,903)
OMCL: Council-Manager	42	771.4	18.4	975,170	23,218.3	2,915.2	Springfield (3,528)	Franklin TWP (57,921)
OMCL: Small Municipality	18	261.2	14.5	132,959	7,386.6	2,158.4	Estell Manor (1,708)	Stafford (25,522)
OMCL: Mayor-Council-Administrator	2	87.5	43.7	67,254	33,627.0	1,824.2	West Milford (27,825)	North Brunswick (39,429)
Special Charters	11	128.5	11.7	295,969	26,906.3	4,147.3	Hardyston (7,797)	Middletown (67,224)
Total /Average	*566*	*6,866.7*	*13.1*	*8,657,445*	*15295.8*	*3,381.6*		

Source: New Jersey Department of Labor and Workforce Development (2005) - land area, estimated population, and population density; Center for Government Services (2006) - form of government.

The special charter provides a unique form of governmental organization for municipalities through the enactment of a law providing them with their own special charter. The special charter approach has been available for municipalities since the state revised its constitution in 1947.[18] This special charter procedure has become more popular in recent years. Through this special charter, municipalities usually have adopted a unique variation of existing optional forms of government to meet the desires of a particular community. As of January 1, 2005, 11 municipalities operated under special charters.

Table 3-3 reports the number of municipalities and demographics by the form of governmental organization, which is reviewed above. The most recent published data on the form of municipal government is the year 2005 and, thus, the table is constructed based on the form of government in 2005.

B. Classification of Forms of Municipal Government

Although municipalities in New Jersey operate under 12 different forms of governmental organization, they can be categorized into the three general types based on the powers of and relationships between executive and legislative authorities: 1) elected governing body and elected chief executive, 2) elected governing body and appointed chief executive, and 3) elected governing body-administrators (Braun, 2002; Reock, 2002). Table 3-4 shows how 12 different forms of government, which are now available by state laws in New Jersey, fit into the three broad patterns of municipal government.[19]

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18. The special charter was prohibited from 1875 through 1947 by an amendment of the State Constitution (Reock, 2002).
19. Exceptions are 11 municipalities adopting special charters. Because these municipalities are operated under different variations of existing optional forms, they cannot be classified as a whole into any one of the above three categories.

In the elected governing body and elected chief executive pattern, there is a directly elected chief executive, usually called the mayor, and a separately elected legislative body, usually called the council. This pattern is similar to the organizational structure of the federal and state governments in that each chief executive and the legislative body has powers serving as a check on any abuse of the other. The mayor has most executive powers and the council is usually limited to legislative functions. As of January 1, 2005, 329 municipalities could be categorized into this general pattern of municipal government. These municipalities are operated under one of city, town, borough, mayor-council, small municipality, and mayor-council-administrator forms.

The elected governing body and appointed chief executive pattern resembles the forms of private firms. Under this pattern, voters elect members of the governing body that appoints a chief executive. After appointing the chief executive, usually called the manager or administrator, the governing body is limited to the legislative function and the administrative power is delegated to the appointed chief executive. The mayor may be selected by the council from among its own members or be elected directly by the voters, with duties limited to presiding over the council. As of January 1, 2005, 49 municipalities operated under the municipal manager (1923) and the council-manager forms could be categorized into this pattern.

The elected governing body-administrator pattern is government by committee. Under this pattern, voters elect members of the governing body who serve both as the chief executive and as the legislative body. In practice, the legislative powers are usually exercised by the governing body as a whole, while the executive powers are divided among the individual members of the governing body, with each member specializing in some aspect of municipal government. The governing body selects one of their own members as the mayor. As of January 1, 2005, the 176 municipalities using township, village, and commission forms of government could be considered as falling into this pattern of government.

Table 3-4. Forms of Municipal Government by General Pattern of Organization in 2005

	Elected Governing Body & Elected Chief Executive	Elected Governing Body & Appointed Chief Executive	Elected Governing Body-Administrators
Old Forms			
City	15		
Town	9		
Borough	218		
Township			144
Village Form			1
Optional Forms			
Commission			32
Municipal Manager (1923)		7	
OMCL: Mayor-Council	67		
OMCL: Council-Manager		42	
OMCL: Small Municipality	18		
OMCL: Mayor-Council Administrator	2		
Special Charters		Mixed - 11	
Total Number of Municipality	329	49	177

Source: Center for Government Services (2006).

3-1-3. School Districts

In New Jersey, the state government and the local school district are responsible for providing public education services. Under the State Constitution, every child between the ages of five and eighteen years is entitled to receive a “thorough and efficient" education. The constitution holds the state responsible for achieving the "thorough and efficient" education.

A. Overview of Elementary and Secondary Education

At the state level, the primary administrative authorities for elementary and secondary education are the State Board of Education and the Department of Education. The major function of the State Board of Education is the consideration and adoption of administrative codes, which contain the rules for implementing education laws. The Department of Education enforces the rules and regulations established by the state board. In addition, the Department of Education supervises all schools receiving state funds, apportions school aid and certifies payments, and sets forth minimum standards of study for schools.

At the local level, the local school district is the governmental unit charged with the responsibility for providing public education. In fact, while the state constitution assigns responsibility for education to state government, the state government assigns or delegates most provision of primary and secondary education services to local school districts. To ensure the goal of public education set by state constitution and statutes and to implement the broad education policies set by state government, local school districts superintend and manage the schools; adopt rules for their organization, government, and instruction; and prescribe textbooks and courses of study.

Statistics on schools, enrollments, and education expenditures indicate the growing importance of public education and, thus, the role of local school districts in providing education services. According to *New Jersey Vital Education Statistics*, which is annually published by the NJ DOE, the number of public school enrollments and the number of public schools grew steadily during the period from 2000 through 2005. The total number of public schools rose from 2,363 to 2,422. Enrollments in elementary school rose from 934,502.5 to 956,299 and enrollment in secondary school from 378,891.5 to 437,482.

The cost of public elementary and secondary education is shared among the federal government, the state government, and the property taxpayers of the local school district. As we will see in Table 3-12, in New Jersey, the largest amount of education expenditures is financed by local property taxes, constituting over 60% of total spending for education. State contribution to education expenditure follows behind the local government with about 40% of total education expenditure. The federal share is very small and is omitted in the analysis due to lack of data. The statistics indicates that, although the state government has increased its role in education, the school district is still the main governmental unit in providing public elementary and secondary education.

Table 3-5. Public Schools and Enrollments (2000-2005)

Starting School Year	2005	2004	2003	2002	2001	2000
Schools						
Total	2,422	2,413	2,398	2,384	2,381	2,363
Elementary	1,943	1,936	1,926	1,911	1,906	1,890
Secondary	398	398	391	390	389	386
Handicapped	81	79	81	83	86	87
Enrollments						
Total	1,393,781.5	1,391,169.5	1380,881.5	1,367,289.5	1,341,503.0	1,313,394.0
Elementary	956,299.5	961,321.0	960,143.0	959,155.0	950,703.5	934,502.5
Secondary	437,482.0	429,848.5	420,738.5	408,134.5	390,799.5	378,891.5

Source: NJ DOE (2007).

Notes: Students can attend public school full time or attend two schools on a shared-time basis. Full time student are reported as 1 and shared-time students are reported as 0.5 at each school.

B. Local School Districts

With development of public education as a governmental activity in the 19th century, school districts were created in New Jersey (Benecke, 2004a). As of October 15, 2007, there were a total of 616 local school districts in New Jersey. These local school districts are independent local governmental units established to provide public education services to their residents. Although local school districts are regulated by the federal and state governments, they can implement any policy as long as it does not violate the federal or state statutes and regulations.

Local school districts can be classified by several criteria such as the type of operation, the authority to tax, the jurisdiction, and the structure of the governing body authorized by the state education law. These classifications are useful in understanding the function of the school district and its relation to other local governmental units, especially municipalities. Table 3-6 provides the total number of school districts and the number of school districts by type, and these figures are almost constant during the period from 2000 through 2007.

By the operation type, there were 593 operating and 23 non-operating school districts as of October 15, 2007. The non-operating school district has been established legally with a board of education, but does not operate any schools. Considering the power to tax, school districts are classified into 574 fiscally independent school districts having authority to tax and 42 school districts having no power to tax. The 42 school districts without power to tax include 21 county vocational school districts, 8 county special service school districts, and 12 educational services commissions.

The county vocational school district may be established by the county board of chosen freeholders or by referendum for vocational education. The county special services school district is established by the county board of chosen freeholders for the education of handicapped children. The educational services commission is a public, non-profit organization which provides educational programs for its constituent school districts.

The 574 fiscally independent school districts provide elementary and secondary education. Based on their jurisdictions, these fiscally independent school districts can be further classified into regular school districts, and regional or consolidated school districts. While regular school districts have the same geographic boundaries as municipalities, 70 regional and 8 consolidated school districts serve more than one municipal area.

Table 3-6. Number of School Districts (2000-2007)

Starting School Year	2007	2006	2005	2004	2003	2002	2001	2000
Total	616	615	615	616	616	616	615	616
By Operating Type								
Operating	593	592	592	593	593	593	592	593
Non-Operating	23	23	23	23	23	23	23	23
By Budget Type								
Independent	574	574	574	574	574	574	574	575
Regular	496	496	496	496	496	496	495	496
Regional	70	70	70	70	70	70	71	71
Consolidated	8	8	8	8	8	8	8	8
County Vocational	21	21	21	21	21	21	21	21
Others	21	20	20	21	21	21	20	20

Source: Center for Government Services (2001-2006) – statistics by budget type; NJ DOE (2007) - total statistics and statistics by operation type.

Notes: Others include county special service school districts and educational services commissions.

Regional school districts are formed when two or more school districts combine for a limited purpose as in establishing a Kindergarten through grade 12 or a grade 9 through grade 12 school district (NJ DOE, 2007). Consolidated school districts are formed through the merger of two or more existing municipalities into a single school district. In New Jersey, school district jurisdictions are always coterminous with municipal boundary or boundaries. This means that although the regional or the consolidated school districts govern more than one municipal jurisdiction, they do not encompass less than the total area of one municipality.

C. Legal Classification of Local School Districts

The New Jersey state education law (N.J.S.A.18A:9-2 to 3) classifies local school districts as either Type I or Type II school districts. As of October 15, 2005, among 574 independent school districts, there were 20 Type I school districts and all other independent school districts were classified as Type II school districts, with the exceptions of 3 school districts operated by the state government. Those 3 state operated school districts are Newark, Jersey City, and Paterson school districts. All regional and consolidated school districts are classified as Type II school districts.

The state education law (N.J.S.A.18A:9-4 to 6) allows voters of a school district to change the Type of school district through a referendum at the annual school election. The process can be initiated either by a resolution of the municipal governing body in Type I school districts, by a resolution of the board of education in Type II school districts, or by a petition signed by 15% of the number of voters who voted in the last general election at which all members of the general assembly were elected.

Between the Type I and the Type II school district, there are critical differences in the selection method of board of education members, the power of the education board, and the relationship between the school district and the municipal government. These differences are summarized in Table 3-7.

Table 3-7. Characteristics of Type I and II School Districts

	Type I	Type II
School Board	Appointed by the mayor	Elected by the voter
Budget Approval	By the board of school estimate By the municipal governing body where the tax rate exceeds $1.5 per $100 assessed valuation	By the voter
Bond Issue Approval	The board of school estimate The municipal governing body	By the voter
Election	No	Annual election

Source: Benecke (2004a)

D. Board of Education

The local school district is governed by the board of education. The members of the education board are local education policy-makers. While the state government establishes the broader framework within which school districts must operate, the board of education sets many of the policies and procedures that most directly affect students and school staffs. The board of education members meet regularly to discuss personnel, finance, curriculum, and other relevant issues. The size of the local board of education may be three, five, seven, nine, or eleven members.

The selection method of board of education members differs by the legal type of school district. While the board of education members are appointed by the mayor in Type I school districts, voters elect education board members for three-year staggered terms in Type II school districts. In the Type II regional or consolidated school districts, the number of board of education members is apportioned among the member school districts participating in the regional or consolidated school district according to the population of the member school districts. The voters within each member school district elect the apportioned education board members.

One of the most important duties of the board of education is to determine the amount of money to be raised by local property taxes for schools and school bond issuance to finance any capital projects. This annual budget process of school districts is quite different between the Type I and Type II school districts.

In a Type I school district, the annual budget is prepared by the board of education and is submitted for approval to the board of school estimate, which consists of the mayor, two members of the school board, and two members of the municipal governing body (Benecke, 2004a). School debt and the amount to be raised by property tax must be included in the official municipal budget. School debt is considered part of the municipality’s responsibility to the extent that the municipal governing body must directly appropriate the capital funds. However, school debt service is raised as part of the property tax allocated for schools.

In a Type II school district, the annual budget of the school district is also established by the board of education. However, unlike the Type I school district, the school tax levy and school debt are submitted for voter approval in a school district election (Benecke, 2004a). School debt is an obligation of the school district alone, rather than of the municipality. The budget of Type II consolidated or regional school districts must be submitted to the voters of the member school districts for approval.

The board of education has the power to appoint school district personnel such as the superintendent of schools, the school business administrator, and the board secretary, among others (Benecke, 2004a). The superintendent of schools is the chief administrative officer of the school district. The duties of the superintendent include almost all activities of the school district such as maintaining the quality of educational programs and services, directing and supervising the administrative staff, initiating and supervising development of the annual budget, and overseeing school facility management (N.J.S.A. 18A:17-15).

The school district's staff includes a school board secretary. In addition, the position of business administrator may be established as a separate position (Benecke, 2004a). In many school districts, the business administrator also serves as the education board secretary. The business administrator is generally responsible for the day-to-day administrative operations of the school district, including purchasing, budget control, payroll processing and general control of cash receipts and disbursements (N.J.S.A. 18A:17-14.1).

Another financial officer of the school district is the treasurer of school monies. This is a statutory position assigned to the treasurer of the municipality, unless the board of education designates the tax collector or clerk (N.J.S.A.18A:17-31 to 36). The basic duties of the treasurer are to reconcile and certify the receipts and disbursements of the school district. In regional or consolidated school districts containing more than one municipality, the treasurer comes from the constituent municipality which has the largest amount of taxable property value (Benecke, 2004a).

3-1-4. Other Local Governmental Entities

In New Jersey, state law authorized local governmental units other than counties, municipalities, and school districts, to be also able to provide public services. With sufficient administrative and fiscal autonomy to qualify as separate governmental units, these local governmental units perform a single or a limited number of functions. Based on power to tax and independence from counties or municipalities, these local governmental units can be classified into a special district, a self-liquidating municipal utility, and a public authority. Table 3-8 provides the total number of and property taxes for special districts for the years 1993, 2004, and 2005.[20]

A. Special Districts

In New Jersey, special districts were originally developed to provide public services to unincorporated areas or sparsely populated rural areas not served by any local or state government. Counties and municipalities can create special districts to perform specific functions within their jurisdictions. Special districts are generally autonomous with their own power to tax, impose service charges, and issue bonds, and their officials are usually elected (Benecke, 2004a).

The typical service areas of special districts are fire, garbage, sewerage, water, and business improvement. The service is provided to the entire region or to a geographical area of a local government jurisdiction. Thus, several special districts providing the same service may exist within a local government jurisdiction. The annual budget of special districts, including the property tax levy, is determined by their elected

20. Same data for self-liquidating municipal utilities and public authorities are not available.

governing body or by the local government governing body. The special district budget is subject to approval by voters or by the local government governing body.

Table 3-8. Number of Special Districts in New Jersey

Year	Total	Fire	Special Improvement	Garbage/Solid Waste	Water	Light	Total Tax Levy ($)
2005	238	193	32	12	1	0	198,865,404
2004	237	192	31	12	2	0	184,371,768
1993	244	201	4	15	2	22	107,550,000

Source: NJ DLGS (1994) – 1993 data; NJ DLGS (2004-05) – 2004-05 data.

B. Self-Liquidating Utilities

A self-liquidating municipal utility is a governmental entity created to perform a specific function or functions within a local government jurisdiction or region (Benecke, 2004a). The self-liquidating utility provides numerous public services such as water, sewer, harbor, electric, and solid waste. Unlike special districts, the self-liquidating utility is not independent from local governments since the governing body of the local government is responsible for the budget and operations of the self-liquidating municipal utility. The annual budget of a self-liquidating utility is included in the municipal budget as a required separate section. The main revenue for financing operation costs, debt service, and capital spending comes from user fees and charges.

C. Public Authorities

A public authority is a corporate public entity created by local governments to provide specific services within a local unit or region. New Jersey local governments have extensively utilized the public authority (Benecke, 2004a). The public authority can be characterized as quasi-public in that it performs a public function without power to tax.

Public authorities provide specific services, such as landfill disposal, sewerage processing, and water delivery. The public authority and the municipality normally enter into a service agreement which establishes the terms and conditions under which the services are delivered.

3-2. Expenditures and Revenues of Local Governments

In New Jersey, counties, municipalities, school districts, and other special districts are operating to provide local public services and goods. This section describes what services these local governments provide and how they are financed. First, this section provides a brief overview of the local government budget process: what is the budget, who is responsible for the budget, and how the budget process is controlled. Second, this section provides a profile of expenditures and revenues by state and local governments.

3-2-1. Local Government Budget Process

The two major policy decisions to be made by local governments are the level of public services to be provided and the amount of money to be raised for financing these public services. These two policy decisions are made through the annual budget process. A budget is a financial plan involving the two policy decisions: the estimate of expenditures for public services and the proposed method of financing these expenditures through various revenue sources. The local government budget constitutes two functions of authority. First, it establishes the appropriations necessary to meet the estimated expenditures (Benecke, 2004a). Second, it provides the power to tax to provide the revenue needed to bring the budget into balance (Benecke, 2004a). Since it must be adopted annually, the budget is the most important action of local governments.

In New Jersey, although no law requires the governing body of a local government to actually prepare the budget, the governing body officials usually involve themselves deeply either as individuals or through committees in the administrative aspects of budget decisions (Benecke, 2004b). Through the annual budgetary process, the governing body of the local government establishes appropriations for specific funding units such as police, fire, and public works, and identifies sources of revenues to fund the expenditure. In addition, the governing bodies of all local governments are responsible for the final adoption of the budget (Benecke, 2004a). The governing body can amend the budget prior to the time of holding the public hearing and during or after the public hearing.

In New Jersey, local government budgets are subject to state laws and are supervised by the state government. Municipalities and counties must comply with the provisions of the Local Budget Law (N.J.S.A. 40A:4-1 et seq.) and school districts must comply with the provisions of the Comprehensive Educational Improvement and Financing Act of 1996 (CEIFA). These laws prescribe the timing, general content, required local government governing body action, and other important aspects of the local government budget process. The Local Budget Law also requires that a formal public hearing be held prior to the final adoption of the local budget. This allows public input and discussion prior to the budget being adopted. Citizens may play an important role either in reviewing and supporting proposed budgets, or even in providing input to the structure of the budget.

The local budget process is also controlled by the state government. Budgeting, accounting, and auditing are controlled by the Division of Local Government Services in the Department of Community Affairs for counties and municipalities and by the Department of Education for school districts. The Division of Local Government Services and the Department of Education establish procedures and regulations which local governments are required to adhere to under uniform budgetary forms. In addition, the Division of Taxation in the Department of Treasury is responsible for the supervision of property tax assessment at the municipal, county, and state levels. The director of the Division of Taxation has the statutory responsibility for supervision and coordination of local property tax assessment and tax procedures.

3-2-2. Expenditures of Local Governments

In New Jersey, the state and local governments share responsibility, at least to some extent, for delivering most public services. The assignment of service responsibilities among the state and the local governments can be based on provisions of state constitution and statutes. However, it is a daunting task to identify the service responsibility through examining state constitutional and statutory provisions. Data on expenditures by state and local governments can provide some evidence on the assignment of service responsibilities among the state and local governments.

Classifying government expenditure is important in identifying the relative role in providing various public services through government expenditures. Government expenditures can be grouped by several criteria such as accounting or object, government function, program or project, executing agency or entity, and so on. A classification by function is most widely used and is useful in analyzing the service responsibilities. The U.S. Census Bureau's data on state and local government finances, in which government expenditures are classified based on government function, is used to review the functions of state and local governments. [21]

Table 3-9 shows expenditures of state and local governments by function with the percentage of each category and state and local shares in each category. It provides some perspective on the relative importance of these various government activities by total and by levels of government. The table reveals that education, social service, and public safety are the three largest components of state-local government spending. Education, social service, and public safety expenditures constitute about 34%, 18%, and 7.5 %, respectively, of all dollars spent by state and local governments.

The importance of government functions differs by state and local governments. State government is the predominant provider of social service, transportation, and utility services. Social service expenditure of state government represents about 25% of state total expenditure and about 90% of total social expenditure by state and local governments. Although education is the second largest component of state expenditure (about 13%), the state's portion is slightly over 24% of total education spending by state and local governments. [22] On the other hand, although transportation and utility expenditures take only about 4 % each of total state spending, the state's proportion of total state-local spending on these two services is about 62% and 71%, respectively.[23]

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21. According to the U.S. Census Bureau's data on state and local government finances, local government expenditures are classified into followings: education - higher education, elementary and secondary education, and libraries; social service - public welfare, hospitals, and health; transportation - highways, airports, parking, and port facilities; public safety - police, fire, and correction; environment and housing - natural resources, parks and recreation, housing, sewerage, and solid waste; governmental administration - financial judicial and legal, and general public buildings; public utility - water, electric power, gas, and transit; and others - interest on debt, insurance trust, and other expenditures.
22. State government is responsible for the higher education and its share of total higher education expenditure is about 80%.
23. Capital expenditure takes over 50% of state's transportation expenditure and transit service expenditure represents over 95% of state's utility expenditure.

Table 3-9. State and Local Government Expenditure by Functions (2003-04 ~ 2005-06)

Year	2005-06			2004-05			2003-04		
	Total*	State	Local*	Total*	State	Local*	Total*	State	Local*
Total Expenditure*	82,928,181	54,073,301	40,193,729	79,845,099	50,964,235	39,835,246	74,335,925	48,975,600	36,220,682
Intergovernmental Expenditure*	49,906	11,060,423	328,332	0	10,642,426	311,956	0	10,565,755	294,602
	(0.1%)	(20.5%)	(0.8%)	(0.0%)	(20.9%)	(0.8%)	(0.0%)	(21.6%)	(0.8%)
Direct Expenditure	82,878,275	43,012,878	39,865,397	79,845,099	40,321,809	39,523,290	74,335,925	38,409,845	35,926,080
	(99.9%)	(79.5%)	(99.2%)	(100.0%)	(79.1%)	(99.2%)	(100.0%)	(78.4%)	(99.2%)
		(51.9%)	(48.1%)		(50.5%)	(49.5%)		(51.7%)	(48.3%)
Education	28,167,152	7,019,789	21,147,363	26,987,883	6,648,228	20,339,655	24,999,848	6,104,928	18,894,920
	(34.0%)	(13.0%)	(52.6%)	(33.8%)	(13.0%)	(51.1%)	(33.6%)	(12.5%)	(52.2%)
		(24.9%)	(75.1%)		(24.6%)	(75.4%)		(24.4%)	(75.6%)
Social Services	15,448,620	13,897,075	1,551,545	14,397,828	12,892,200	1,505,628	13,142,527	11,741,334	1,401,193
	(18.6%)	(25.7%)	(3.9%)	(18.0%)	(25.3%)	(3.8%)	(17.7%)	(24.0%)	(3.9%)
		(90.0%)	(10.0%)		(89.5%)	(10.5%)		(89.3%)	(10.7%)
Transportation	3,718,034	2,427,531	1,290,503	3,267,356	2,002,806	1,264,550	3,266,628	2,071,976	1,194,652
	(4.5%)	(4.5%)	(3.2%)	(4.1%)	(3.9%)	(3.2%)	(4.4%)	(4.2%)	(3.3%)
		(65.3%)	(34.7%)		(61.3%)	(38.7%)		(63.4%)	(36.6%)
Public Safety	6,225,551	2,179,658	4,045,893	5,884,360	2,064,519	3,819,841	5,528,681	1,905,866	3,622,815
	(7.5%)	(4.0%)	(10.1%)	(7.4%)	(4.1%)	(9.6%)	(7.4%)	(3.9%)	(10.0%)
		(35.0%)	(65.0%)		(35.1%)	(64.9%)		(34.5%)	(65.5%)
Environment & Housing	4,786,984	1,291,053	3,495,931	5,913,550	1,082,706	4,830,844	4,302,620	984,675	3,317,945
	(5.8%)	(2.4%)	(8.7%)	(7.4%)	(2.1%)	(12.1%)	(5.8%)	(2.0%)	(9.2%)
		(27.0%)	(73.0%)		(18.3%)	(81.7%)		(22.9%)	(77.1%)
Governmental Administration	3,262,755	1,707,866	1,554,889	3,183,702	1,633,219	1,550,483	3,054,388	1,554,208	1,500,180
	(3.9%)	(3.2%)	(3.9%)	(4.0%)	(3.2%)	(3.9%)	(4.1%)	(3.2%)	(4.1%)
		(52.3%)	(47.7%)		(51.3%)	(48.7%)		(50.9%)	(49.1%)
Utility	3,297,597	2,334,865	962,732	3,256,054	2,302,798	953,256	3,202,453	2,259,558	942,895
	(4.0%)	(4.3%)	(2.4%)	(4.1%)	(4.5%)	(2.4%)	(4.3%)	(4.6%)	(2.6%)
		(70.8%)	(29.2%)		(70.7%)	(29.3%)		(70.6%)	(29.4%)
Others	17,971,582	12,155,041	5,816,541	16,954,366	11,695,333	5,259,033	16,838,780	11,787,300	5,051,480
	(21.7%)	(22.5%)	(14.5%)	(21.2%)	(22.9%)	(13.2%)	(22.7%)	(24.1%)	(13.9%)
		(67.6%)	(32.4%)		(69.0%)	(31.0%)		(70.0%)	(30.0%)

Source: U.S. Census Bureau (2003-04 ~ 2005-06).

Notes: 1. Dollar amounts are in thousands. 2. Local government figures are the sum of expenditures of counties, municipalities, school districts, and other special districts. 3. * Duplicative intergovernmental transactions are excluded. 4. The second and the third row of each expenditure category represent the percentage of each expenditure category to the total expenditure and the proportion of state and local governments combined in the expenditure category, respectively.

The major financing responsibilities of local governments are education, public safety, and environment and housing services.[24] Education expenditure accounts for

24. Housing is primarily a private sector activity. However, some housing is provided by the public sector, with local governments generally taking the lead role.

about 52% of total local government expenditures and slightly more than 75% of total state-local expenditure on education. Local governments are primarily responsible for elementary and secondary education, and contribute about 90% of total expenditure on this category.[25] While local government expenditures on public safety and environment and housing are the second and third largest components, each represents only 10% of total local spending. However, local governments finance over 70% of total state-local expenditures on environment and housing services and about 65% of state-local expenditure on public safety. The responsibility of local governments with lowest expenditure is social services, contributing only about 10% of total state-local social expenditures.

A basic understanding of local government fiscal behavior requires detailed information on the amounts spent by each type of local government. Table 3-10 compares total expenditures by type of local government for the period from 2004 through 2007 with the percentage change and the percentage which each type of government represents of the aggregate.[26] The growth in expenditures by local government in New Jersey during the period is clear. Local governments spent 34.36 billion dollars in 2004 and the total expenditure had increased 16.3% by 2007. During the period, counties, municipalities, and school districts annually increased their expenditures by 6.0%, 6.2%, and 4.9%, respectively.

In the relative importance by the type of government, school districts report the largest expenditure during the period, constituting about 57% of the total local

25. Local government expenditures on this category include state aid to school districts.

26. The total local government expenditure in Table 3-10 is smaller than that in Table 3-9 because expenditures of special districts are dropped in Table 3-10 due to lack of data.

expenditure. Municipalities and counties follow with 28% and 14%, respectively. The share of each government also has been changed. While school districts' share decreased from 58.2% to 57.4%, municipalities' and counties' increased from 27.4% to 28% and 14.3% to 14.5%, respectively. Although the period examined here covers a short duration of time, these shifts may reflect both changes in service demands and changes in the system for delivering local public services. It may also reflect shifts in available revenues, particularly regarding intergovernmental aid from state government.

Table 3-10. Local Government Spending by the Type of Local Government (2004-2007)

Year	2007	2006	2005	2004
Total	39.94 (4.6%)	38.20 (5.1%)	36.35 (5.8%)	34.36
County	5.81 (5.8%) (14.5%)	5.49 (5.6%) (14.4%)	5.20 (5.7%) (14.3%)	4.92 (14.3%)
Municipality	11.19 (5.4%) (28.0%)	10.62 (5.4%) (27.8%)	10.08 (6.9%) (27.7%)	9.43 (27.4%)
School District	22.94 (3.8%) (57.4%)	22.09 (4.8%) (57.8%)	21.07 (5.3%) (58.0%)	20.01 (58.2%)

Source: NJ DLGS (2000-2007a).

Notes: 1. Dollar amounts are in Billions. 2. The second and the third rows of each type of local government represent annual change and each type of local government's share of total expenditure, respectively.

3-2-3. Revenues of Local Governments

An essential part of the government budget is the revenue section indicating the amount of revenue by sources, which is required for financing various public services. State and local governments are required to raise a substantial portion of their revenues using their own taxing and charging powers. The major revenue items in the government's annual budget include tax revenues, user charges and fees, intergovernmental transfers form other levels of government, and other miscellaneous revenues. Table 3-11 shows revenues of state and local government by source with the percentage of each revenue source during the period from fiscal year 2003-04 through the 2005-06 fiscal year. In addition, it also reports state and local shares in each revenue category.

Taxes are the main source of state-local revenues and represent over 52% of total state-local revenues. The main tax instruments for state and local governments in New Jersey are property, sales, and income taxes. The second largest amount of revenue comes from user charges and fees, which contribute almost 17% of total state-local revenues. Other miscellaneous revenues follow with approximately 15% of total state-local revenues. These own sources for revenues represent over 85% of total state-local revenues. The remaining revenue comes from intergovernmental transfers from other levels of governments.

If state and local governments are looked at separately, the relative importance of each revenue source differs by state and local governments. The data reveals that taxes constitute about 40% of total state revenues and slightly more than 50% of total local government revenues. State government depends heavily on sales taxes and income taxes. Income taxes constitute more than 20% of total state revenues and are used exclusively for state government. Revenue from sales tax is the next major state government source of revenue. Sales tax contributes nearly as much as income tax to the total state revenue (almost 19%). Although local governments are also allowed to levy sales tax, it generates an almost negligible amount of local revenue (about 0.2%). On the other hand, a primary revenue source for local governments is the property tax. Local governments rely heavily on property taxes, which constitute more than 50% of total local government revenue.

The second largest revenue for state and local government comes from various charges and fees for the use of many public services. The state government relies for about 15% of total state revenues on user charges and fees for public services provided, especially on fees and charges for highway, hospital, and higher education usage. User charges and fees also represent approximately 14% of total local revenues and usually come from sewerage and solid waste, and higher education services. Finally, state and local governments earn other miscellaneous types of revenue from charges for use of public utilities and interest. The state government raises about 19% of state revenue from other miscellaneous revenues, which include user charges for the use of public transit service and interest earned on cash balances deposited in interest-earning accounts. Local governments, on the other hand, rely for slightly over 2% of total local revenues on this revenue category. Local miscellaneous revenue comes mainly from charges for water service.

In addition to their own sources of revenues mentioned above, state and local governments rely for a considerable proportion of their revenue on intergovernmental transfers. About 19% of state government revenue is derived from transfers from other levels of governments. Local governments receive more than 30% of total local revenue from transfers from other levels of government, especially the state government. Whatever the cause, New Jersey was ranked first in property tax per capita in 2006 (Tax Foundation, 2008). In 2002, as a share of state-local revenues and as a share of local revenues, New Jersey was ranked in the top five states (U.S. Census Bureau, 2002;

Regional Plan Association, 2005). To relieve the property tax burden of residents and reduce local governments' reliance on property taxes, the state government plays an important role in financing local government mainly by channeling money to the local governments through state aid programs. While the Department of Education allocates state aid funds to school districts, state aid to counties and municipalities is governed mainly by the Department of Community Affairs. Some state aid to local governments is formula based while others are provided through competitive grants.

Table 3-11. State and Local Government Revenues by Source in New Jersey (2003-04 ~ 2005-06)

Year	2005-06			2004-05			2003-04		
	Total*	State	Local*	Total*	State	Local*	Total*	State	Local*
Total*	85,516,847	57,610,331	39,887,281	79,125,811	52,661,668	38,303,150	75,527,008	51,041,285	35,658,032
Intergovernmental Revenue*	11,746,301 (13.7%)	11,378,454 (19.8%)	12,348,612 (31.0%)	10,626,825 (13.4%)	10,258,349 (19.5%)	12,207,483 (31.9%)	10,163,630 (13.5%)	9,815,674 (19.2%)	11,520,265 (32.3%)
Taxes	47,307,677 (55.3%)	26,266,187 (45.6%)	21,041,490 (52.8%)	43,871,003 (55.4%)	24,247,648 (46.0%)	19,623,355 (51.2%)	39,558,277 (52.4%)	20,986,204 (41.1%)	18,572,073 (52.1%)
Property	20,549,427 (24.0%)	3,479 (0.0%) (0.02%)	20,545,948 (51.5%) (99.98%)	19,196,599 (24.3%)	3,484 (0.0%) (0.02%)	19,193,115 (50.1%) (99.98%)	18,229,254 (24.1%)	3,660 (0.0%) (0.02%)	18,225,594 (51.1%) (99.98%)
Sales	10,608,212 (12.4%)	10,493,283 (18.2%) (98.9%)	114,929 (0.3%) (1.1%)	10,238,453 (12.9%)	10,171,999 (19.3%) (99.4%)	66,454 (0.2%) (0.6%)	9,780,318 (12.9%)	9,740,284 (19.1%) (99.6%)	40,034 (0.1%) (0.4%)
Income	13,014,993 (15.2%)	13,014,993 (22.6%) (100.0%)	0 (0.0%) (0.0%)	11,762,572 (14.9%)	11,762,572 (22.3%) (100.0%)	0 (0.0%) (0.0%)	9,297,731 (12.3%)	9,297,731 (18.2%) (100.0%)	0 (0.0%) (0.0%)
Other Taxes	3,135,045 (3.7%)	2,754,432 (4.8%)	380,613 (1.0%)	2,673,379 (3.4%)	2,309,593 (4.4%)	363,786 (0.9%)	2,250,974 (3.0%)	1,944,529 (3.8%)	306,445 (0.9%)
Charges and Fees	14,333,873 (16.8%)	8,801,264 (15.3%)	5,532,609 (13.9%)	13,254,239 (16.8%)	7,678,085 (14.6%)	5,576,154 (14.6%)	12,315,192 (16.3%)	7,554,939 (14.8%)	4,760,253 (13.3%)
Others	12,128,996 (14.2%)	11,164,426 (19.4%)	964,570 (2.4%)	11,373,744 (14.4%)	10,477,586 (19.9%)	896,158 (2.3%)	13,489,909 (17.9%)	12,684,468 (24.9%)	805,441 (2.3%)

Source: U.S. Census Bureau (2003-04 ~ 2005-06).

Notes: 1. Dollar amounts are in thousands. 2. Local government figures are the sum of revenues of counties, municipalities, school districts, and other special districts. 3. * Duplicative intergovernmental transactions are excluded. 4. The second row of each revenue source represents its share of total revenues, and the third row in property, sales, and income taxes provides the proportion of state and local governments.

While local governments, as combined, derive a considerable portion of their revenues from property taxes, user charges and fees, and state aid, the reliance on each of these revenue sources may differ by the type of local government. Table 3-12 shows the amount and contribution of each source of revenue to total revenue by type of local government. While municipal figures include miscellaneous revenues, county and school district figures consist of only property tax revenue and state aid due to the lack of data on miscellaneous revenues of counties and school districts. Regardless of the type of local government, while the proportion of property tax to total revenues has increased, that of state aid has reduced during this period.

Even considering the omission of miscellaneous revenues, property taxes represent a considerable portion of county government revenues. In addition, the reliance on property tax revenue has increased. Compared to the property tax revenues, transfers from state to county government make a very small portion of county revenues and its share of county revenue has declined. In the case of municipalities, the major contributors to their revenue are miscellaneous revenues and property tax revenues, which represent, on average during the period, 43% and 42% of total municipal revenues, respectively.[27] State aid to municipalities represents only about 15% of total revenues. Municipalities have increased the role of property taxes in the financing of services by 6.1%, as the reliance on miscellaneous revenues and state aid has been reduced by 2.7% and 3.3%, respectively. Unlike counties and municipalities, school districts rely heavily on transfer revenues from the state government. Almost 40% of total school district revenue is derived from state aid. However, the property tax is still the main revenue source and it

27. Municipalities' miscellaneous revenues include surplus revenue, receipts from delinquent tax, and revenue from charges and fees.

contributes about 61% of total school district revenues. In addition, school districts' reliance on property tax has increased from 58.8% to 62.3% during this period.

Table 3-12. Revenues by the Type of Local Government (2000-2007)

Year	2007	2006	2005	2004	2003	2002	2001	2000
County								
Total	5,043,099	4,813,363	NA	NA	4,090,083	NA	NA	NA
Property Tax	4,179,318 (82.9%)	3,960,988 (82.3%)	3,716,557	3,506,903	3,324,450 (81.3%)	3,140,369	2,914,074	2,748,945
State Aid	863,781 (17.1%)	852,375 (17.7%)	NA	NA	765,633 (18.7%)	NA	NA	NA
Municipality								
Total	13,027,884	12,423,290	11,730,070	11,145,008	10,636,009	10,275,744	9,950,601	9,492,573
Property Tax	5,882,848 (45.2%)	5,459,896 (43.9%)	5,038,923 (43.0%)	4,686,968 (42.1%)	4,387,009 (41.2%)	4,079,641 (39.7%)	3,876,752 (39.0%)	3,713,573 (39.1%)
Miscellaneous	5,417,900 (41.6%)	5,266,557 (42.4%)	4,996,683 (42.6%)	4,799,962 (43.1%)	4,608,565 (43.3%)	4,563,767 (44.4%)	4,439,655 (44.6%)	4,209,067 (44.3%)
State Aid	1,727,136 (13.3%)	1,696,836 (13.7%)	1,694,463 (14.4%)	1,658,078 (14.9%)	1,640,435 (15.4%)	1,632,336 (15.9%)	1,634,194 (16.4%)	1,569,933 (16.5%)
School District								
Total	19,373,704	18,586,669	17,751,374	16,624,530	15,494,224	14,703,873	13,979,395	13,142,296
Property Tax	12,068,737 (62.3%)	11,493,877 (61.8%)	10,812,297 (60.9%)	10,183,622 (61.3%)	9,542,525 (61.6%)	8,815,244 (60.0%)	8,201,165 (58.7%)	7,732,552 (58.8%)
State Aid	7,304,967 (37.7%)	7,092,791 (38.2%)	6,939,078 (39.1%)	6,440,907 (38.7%)	5,951,699 (38.4%)	5,888,628 (40.0%)	5,778,231 (41.3%)	5,409,744 (41.2%)

Source: NJ DOE (2000-01 ~ 2007-08) - state aid to school districts; NJ DLGS (2000-2007a) – property tax and miscellaneous revenue; NJ DLGS (2000-2007b) - state aid to municipalities and counties.

Notes: 1. Dollar amounts are in thousands. 2. NA - Not available.

3-3. Property Tax Administration

On the revenue side of the budget, the various sources of revenue and their anticipated amounts are examined. These revenues are used to support spending and the amount of property taxes is a critical focus of the annual local budget process in New

Jersey. As shown in the previous section, local governments in New Jersey rely highly on the property tax for financing local public services. The property tax in New Jersey is a local tax. This means that the property is assessed and taxes are collected at the local level for the support of municipal government, local schools, and county governments. This section examines the characteristics of the property tax as a source of revenue for local governments, and then outlines the administration of the property tax, which involves tax levy determination, property assessment, tax rate extension, and tax collection.

3-3-1. Property Tax as a Revenue Source

In the United States, the property tax has been subject to criticism from many sources and has been one of the most disliked forms of taxation. However, the property tax has many attractive characteristics for financing local governments and, in practice, local governments continue to rely heavily on the property tax.

The property tax meets conditions required for financing local governments better than most other revenue sources. Foremost, unlike other sources of revenue such as income and sales taxes, the property tax provides local governments with stable annual receipts, not subject to fluctuations due to economic conditions (SSJLCCR, 2006). This stability is very important to local governments which have limited financial capacities compared to higher levels of government. Second, the property tax can encourage political accountability by closely linking local public services to the taxes paid by residents. With its visibility, this direct link to local public service benefits encourages balanced local fiscal choices, services levels, and tax burdens (Chicoine and Walzer, 1985; SSJLCCR, 2006). Finally, in terms of tax administration, the property tax has strength in that the property tax base, mainly real estate, is easily identifiable and immobile, and the owner of record can be readily ascertained. In addition, unpaid taxes can be recovered through a tax sale (Chicoine and Walzer, 1985; SSJLCCR, 2006).

However, the property tax has been criticized by practitioners, academics, and citizen taxpayers for several reasons. First, it has been suggested by experts that the property tax is not connected to an individual's ability to pay. Although relief programs for the poor and senior citizens have addressed this regressivity, the property tax is still regarded as collecting proportionally more from the poor (Chicoine and Walzer, 1985; SSJLCCR, 2006). The second weakness of the property tax is the relatively large tax bill to property owners. This makes the property tax highly visible and burdensome (Chicoine and Walzer, 1985; SSJLCCR, 2006). The third negative aspect of the property tax is the uneven assessment. Poor assessment practices lead to inequitable tax bills because the total amount of money to be raised by the property tax is allocated among property owners through the assessment process.

As indicated above, the property tax has strengths and weaknesses. In New Jersey, the property tax remains as a major revenue source for local governments, and its share of total local revenues has increased in recent years. This is because although the amounts of revenues, especially revenues from property tax, is controlled by voters and the state government, there are few other revenue sources for local governments to finance local public services as easily as the property tax. In addition, it is generally accepted that residents benefit from local public services in accordance with the value of property owned.

3-3-2. Property Tax Levy Determination

A. How is the Property Tax Levy Determined?

In New Jersey, the property tax has been used as a main revenue source for the support of municipal governments, school districts, and county governments. The property tax revenues are used for various purposes and the property tax tables, which are annually published by the Division of Local Government Services, specify these purposes. Property taxes for county purposes include general county purposes, county library services, county local health services, the county open preservation trust fund, and the county vocational school. Property taxes for municipal governments are used for the local municipal budget and local municipal open space purposes. School district property taxes include those levied for the local district school budget, for regional, consolidated, and joint school budgets, and for school debt service which is required by the municipal budget in Type I school districts.

In the property tax administration process, the governing body of local governments must determine how much is to be collected from property taxes, which is usually called the property tax levy. The property tax in New Jersey is a residual revenue source financing local services (Reock, 1994). This means that property taxes are levied to support the residual costs of counties, municipalities, and school districts after all other sources of revenue have been anticipated. In the budget of New Jersey local governments, other revenue sources are classified as surplus anticipated, miscellaneous revenues, and receipts from delinquent taxes to support appropriations in the local government budget. Thus, the amount of money required to be raised through property taxation is determined by subtracting these anticipated non-property tax revenues from the total appropriations in the budget.

In the local budget process, it is very important to clearly recognize the inter-relationship of surplus used to support the budget, revenue from delinquent taxes, the annual appropriation of reserve for uncollected taxes, and the property tax levy. In preparing the revenue section of the budget, local government budget officers should project the amount of money from each of these non-tax revenue items as accurately as they can. In determining the amount of money to be raised by property tax, based on these sound predictions, the interplay among these revenue sources should be comprehensively analyzed to assure sound fiscal management.

B. Limits on Property Tax Levy

Local governments in New Jersey operate under spending or taxing limits. These limits are statutory and are intended to control expenditures or revenues of local governments. However, local governments may exceed these limits on tax rates or spending by presenting a referendum to the eligible voters. The voters, then, decide whether or not the limit should be exceeded (Benecke, 2004b).

Although the first budget law for local government was enacted in 1917 (Benecke, 2004b), there were no limits on local budgets. As part of the 1976 state income tax legislation, the local budget cap law (N.J.S.A. 40A:4-45.1 et. seq.) was first enacted to control local property taxes by placing a budgetary cap on local government appropriations (SSJLCCR, 2006). Since then, the local budget cap law has been modified.

In 1990, the budget cap law became permanent and eliminated the many exceptions to the cap that were previously in effect (Benecke, 2004b).

In the preparation of their budgets, municipalities and counties are currently limited to increasing appropriations over the prior year by no more than 2.5% if the Cost of Living Adjustment (COLA) is not more than 2.5% or up to 3.5% if the COLA exceeds 2.5 % based on the local budget cap law.[28] In addition to this appropriation cap, in 2007, the state legislature established a property tax levy cap that limits increases in the property tax levies of counties and municipalities by 4% (SSJLCCR, 2006).

Under the provisions of CEIFA, school districts are subject to an annual percentage increase in spending not to exceed 3% or the Consumer Price Index (CPI), whichever is greater (SSJLCCR, 2006). Like municipalities and counties, the tax levy cap law (N.J.S.A. 18A:7F-38 to 41), which was signed into law in 2007, establishes a 4% cap on increases in school district property tax levies, plus adjustments for increases in enrollment. This new tax levy growth limitation replaces the spending growth limitation under CEIFA and is effective for the 2007-08 through 2011-12 school years (New Jersey Division of Finance, 2008).

3-3-3. Assessment of Property Value

The property tax administration involves a process of assessment, i.e., determining the taxable value of the property on which the property tax is levied. The assessed value of a parcel of real property is the dollar value determined as to the property's worth, relative to all the other taxable real property in the municipality (NJ

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28. The COLA, which was called formerly the index rate, is based on Implicit Price Deflator for State and Local Governments, calculated by the U.S. Department of Commerce, Bureau of Economic Analysis.

OLS, 2005).[29] A property's value is usually equivalent to its taxable value, unless all or a portion of the property is qualified for a tax exemption. Therefore, the total of all assessments less all exemptions is the total taxable value, or tax base, of the municipality (Benecke, 2004b). The assessment of property value is conducted mainly by the municipal tax assessor and the county board of taxation and they frequently interact with each other in the property tax administration.

A. Who Assesses the Property?

The municipal tax assessor is responsible for the assessment of all taxable real property in the municipality. The municipal tax assessor is required to complete a state certification program and is appointed by the governing body of each municipality with a four-year term of office. Although appointed by the municipality, the municipal tax assessor is intended to be independent of the municipality subject to control by the Director of the Division of Taxation in the Department of Treasury (NJ OLS, 2005).

The main duties of the municipal tax assessor include: discovery and location of all property within the municipality; listing all property; determination of taxability of all property; valuation of all property; maintenance of the sales equalization ratio program; maintenance of deduction, exemption, abatement and rebate programs; defense of appeals; supervision and maintenance of reassessment and/or revaluation programs; and cooperation with other officials and the public (New Jersey Division of Taxation, 2001; Pareti, 2001). The municipal tax assessor reports all assessment matters to the county board of taxation and to the municipal governing body for administrative purposes.

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29. In New Jersey, the municipality is the unit in which the property value is assessed, the tax rate is calculated, and the tax is collected.

The county board of taxation is responsible for the equalization, revision, review, and enforcement of property taxes. Just like local governments, the county boards of taxation are “creatures of the State” in that they are authorized by statute. County boards of taxation have either three or five members, depending on the class and population of each county. County board members are appointed by the governor with the “advice and consent” of the State Senate (New Jersey Division of Taxation, 2001; Pareti, 2001).

The county board of taxation is charged by statute with “securing” the taxation of all property in the county and to ensure that all property within its boundaries bears its full and just share of taxes (N.J.S.A. 54:3-17 et seq.). The main responsibilities of a county board of taxation includes supervising the work of the municipal assessors in the county, equalizing property values within the entire county for the purpose of apportioning county taxes among municipalities, and hearing appeals regarding tax assessments from individual taxpayers and taxing districts.

Each county board of taxation appoints a county tax administrator who serves a three-year term of office. Under the supervision and control of the county board of taxation, the county tax administrator is responsible for the administrative functions of the board and the direction of the municipal tax assessor in each municipality. The county tax administrator must prepare and submit to the board of taxation an equalization table showing the necessary ratios and values used in determining each taxing district’s share of the county apportionment (New Jersey Division of Taxation, 2001; Pareti, 2001).

B. How is the Property Assessed?

The uniformity clause of New Jersey Constitution requires all real property to be assessed according to the same standard of value, and taxed at the same tax rate of the taxing district (NJ OLS, 2005).[30] The state law requires the municipal tax assessor to value each parcel of property at its true value by stating that it is "deemed to be valuation at current market prices or values" (N.J.S.A.54:1.35.3, N.J.S.A.54:4-2.25, and N.J.S.A.54:4-23). The constitutional provision and the state statute are intended to ensure that the property tax burden is distributed fairly within a taxing district and that properties are valued according to the prevailing market value. In New Jersey, three programs have been operated for ensuring constitutional and statutory requirements of property tax: equalization, reassessment, and revaluation.

In property tax administration, equalization refers to a process to estimate the true value of taxable property, which is defined as the market value by the state statute. Municipal tax assessors may assess properties in their municipalities at a different percentage of market value than other assessors within the county. Since property is uniformly assessed, based on true value at one particular point in time, generally at the time of a revaluation of property, the assessment of property remains the same over time while market prices tend to increase. Thus, the municipal property assessments have to be annually adjusted to compensate for the difference between the assessment and the market price.

In the equalization process, the true value of taxable properties is found through a massive program by the Division of Taxation. In the statewide assessment-sales ratio studies, sales are classified by type of property and the average ratios between sales prices and assessments are determined for each kind of property (Reock, 1994). These equalization ratios are, then, used to estimate the true value of all taxable properties.

30. In New Jersey, industrial, commercial, and residential properties are assessed based on their true value. No distinction exists between these classes of properties.

The true value of taxable properties is found by multiplying a municipality's total assessment by its equalization ratio.[31] The assumption is that assessments on properties sold are representative of the assessment practices throughout the municipality. Equalized property values are used to fairly apportion the county tax burden among municipalities in the county. They are also used in the formula to distribute state aid to school districts in such a way that the resources of the various school districts are made more equal.

A revaluation is a program undertaken by a municipality through a state-approved contract with a revaluation firm, to appraise all real property within its borders. The purpose of a revaluation is to ensure that the property tax burden is spread equitably among all taxable municipal property owners based on the value of the real property owned by each taxpayer. Periodic revaluation also ensures that improvements or changes to land or buildings are accurately reflected on the municipal tax records so that the owner is properly taxed, thereby assuming his or her fair share of the local property tax burden (New Jersey Division of Taxation, 2001; NJ OLS, 2005).

A reassessment program is an adjustment, or updating, of a previous revaluation or of a previous reassessment. A reassessment program is less thorough than a revaluation program, but it has the same objective to spread the tax burden equitably throughout a municipality. A reassessment program is carried out by the municipal tax assessor. Unlike a revaluation program, outside firms are not involved in a reassessment program. A reassessment plan must be submitted to and approved by the county board of taxation. While a revaluation always adjusts assessments to market value, a reassessment program may only ensure that all properties are assessed using the same standard of value,

31. The equalization ratio is also called the assessment ratio, sales ratio, and assessment-sales ratio.

even if that standard is below market value (New Jersey Division of Taxation, 2001; NJ OLS, 2005).

There is no statutory requirement that a revaluation or a reassessment be performed by a municipality at any given interval. A municipality is required to perform a revaluation when municipal data indicate that properties in the municipality are not being assessed at the same ratio as their true value. One of the best sources of this type of information is the assessment-sales ratio gathered in the equalization process. If the equalization ratio shows a large variation, a revaluation is necessary.

C. Exemption and Deduction of Property Tax

The property owner may reduce his or her liability by receiving an exemption or by applying for a personal deduction. In New Jersey, property tax exemptions and deductions are granted only by the provision of the constitution or by the general law.

New Jersey's constitution and laws provide exemptions from property taxes for a class of property. The constitution currently requires exemptions for property used exclusively for religious, educational, charitable, or cemetery purposes. The constitution grants the legislature the power to enact other exemptions only by general law. These other exempt properties are those used by governments, public authorities, or urban enterprise zones, and may be altered or repealed at any time by the state legislature.

The deductions can take two forms: homestead relief and personal exemptions. The New Jersey constitution also authorizes an annual deduction from property taxes on properties owned by senior citizens, disabled persons, veterans, and their surviving spouses. To implement this constitutional provision, the state legislature has enacted general laws and the Division of Taxation has issued regulations.

The homestead relief program removes specified amounts of assessed property value from the tax base in order to lower property tax liabilities. In New Jersey, the Homestead Property Tax Credit/Rebate Act, which was signed into law in 2007, provides rebates for homeowners and tenants who meet residence and income criteria. Under this act, benefits are based on gross income and the amount of property taxes.[32]

Table 3-13 reports net taxable assessed valuation by type of property, equalization ratio, and equalized value of taxable property for the period from 2000 through 2007. Over the period, state total net taxable value grew at a fairly consistent rate annually, averaging 7.8% and ranging between 3.0% and 12.1%. The state total equalized value shows a similar trend with a greater annual average growth of 11.9% and smaller range between 7.2 and 15.3%.

The average equalization ratio was about 72% with a declining trend during this period. The equalization ratio can be greater or less than 100%. The equalization ratio greater than 100% indicates that property is over-assessed and a ratio which is less than 100% indicates that it is under-assessed. The average equalization ratio indicates that in New Jersey, property has been under-assessed about 30%, on average, during this period.

The table also shows that residential property value constitutes the bulk of the net taxable assessed valuation, 74.6%. Commercial and industrial property values are ranked behind residential property value in relative importance to the composition of the

32. The 2007 Homestead Property Tax Credit/Rebate Program replaces the Fair Rebate Program, which had superseded the New Jersey School Assessment Valuation Exemption Relief (NJ SAVER) Program in 2004.

property tax base, taking 15.0% and 4.9%, respectively. This make up of the property tax base means that when local governments impose a tax on property, this tax will fall most heavily on residential property values.

Table 3-13. Property Tax Base (2000-2007)

Year	2007	2006	2005	2004	2003	2002	2001	2000
Total Net Taxable Value	834,781,642 (12.1%)	744,898,624 (11.5%)	667,928,282 (9.8%)	608,225,242 (6.7%)	570,093,393 (8.2%)	526,949,652 (6.2%)	495,988,917 (4.9%)	472,650,547 (3.0%)
Residential	641,146,309 (12.8%) (76.8%)	568,556,584 (12.9%) (76.3%)	503,695,217 (11.7%) (75.4%)	451,053,303 (7.4%) (74.2%)	420,022,223 (7.9%) (73.7%)	389,360,277 (7.0%) (73.9%)	363,841,952 (5.4%) (73.4%)	345,053,215 (73.0%)
Commercial	115,948,841 (9.7%) (13.9%)	105,705,811 (7.4%) (14.2%)	98,452,963 (4.3%) (14.7%)	94,401,716 (5.4%) (15.5%)	89,558,325 (10.8%) (15.7%)	80,827,515 (5.8%) (15.3%)	76,384,939 (4.8%) (15.4%)	72,887,195 (15.4%)
Industrial	33,845,054 (6.7%) (4.1%)	31,715,177 (4.4%) (4.3%)	30,392,965 (2.9%) (4.6%)	29,532,206 (0.9%) (4.9%)	29,260,837 (5.6%) (5.1%)	27,699,603 (2.0%) (5.3%)	27,169,179 (1.7%) (5.5%)	26,708,242 (5.7%)
Equalization Ratio (%)	62.8	65.4	66.1	64.7	72.8	77.3	81.1	85.6
Total Equalized Value	1,329,627,626 (7.2%)	1,239,769,309 (14.4%)	1,083,746,150 (15.3%)	940,248,785 (14.1%)	823,991,635 (14.2%)	721,225,163 (11.3%)	647,876,990 (10.9%)	584,284,179 (7.6%)

Source: NJ DLGS (2000-2007a).

Notes: 1. Dollar amounts are in thousands. 2. Residential value is the sum of residential property value and farm homestead property value. 3. The second row of each property value represents annual change and the third row of residential, commercial, and industrial values provides its share of total net taxable value.

3-3-4. Property Tax Rate Extension

The property tax rate is the method used to arrive at the amount of each taxpayer's share of property taxes. The property tax rate is expressed as the number of dollars and cents per $100 of property value. The process of calculating the property tax rate is a very routine procedure. Early in the budget process, the amount of money to be raised by property tax for supporting counties, municipalities, school districts, and other special districts is reported to the county board of taxation.[33] In this process, the county board of taxation apportions the tax levy for county government among municipalities in the county. Then, the county board of taxation determines the property tax rate by dividing the sum of the property tax levies for each type of government by the total value of taxable property in a taxing district, which is usually the municipality. Each type of local government in the municipality has a separate tax rate so that a parcel of property can be subject to three or more different property tax rates.

Two different kinds of property tax rates can be calculated by using different property values: a general tax rate and an equalized tax rate. First, the general tax rate is found by dividing the tax levy by the net valuation taxable, which reflects the assessed value of taxable property. This rate is, then, applied to each individual parcel of property to determine the individual tax of each property. The general tax rate is most familiar to taxpayers because it is the tax rate printed on each property owner's tax bill. The process of calculating the property tax rate allocates the property tax among property owners based on the relative value of property owned. Therefore, each property owner's share of the property tax is proportional to his or her share of the total taxable property value within the taxing district:

$$\text{Tax Bill} = \text{Total Property Taxes} \times \frac{\text{Assed Value of Taxpayer's Property}}{\text{Total Assessed Property Value of a Taxing District}}$$

Second, the equalized or effective tax rate is calculated by dividing the property tax levy by the total equalized property value in the taxing district. This equalized tax rate

33. The governing body of a special district in a municipality reports the tax levy to the municipal assessor who calculates the tax rate for the special district. Then, this tax rate is added to the general tax rate for the municipality (New Jersey Division of Taxation, 2001).

is the tax rate which would apply if all taxable property were assessed at its true value. New Jersey defines true value as the market value and conducts a statistical program to determine the average ratio of assessments to the market value in each municipality. If the general tax rate is multiplied by this equalization ratio, the result will be the equalized tax rate of the taxing district. This equalized tax rate is not used to compute the tax bill. However, the equalized tax rate is more useful than the general tax rate when comparing tax rates between communities or over a period of time. This is because tax assessments, which are the value placed on the property by the municipal tax assessor, may vary widely from place to place or from time to time.

Table 3-14 shows the trend of the statewide average general and equalized property tax rates by type of local government from 2000 to 2007. The statewide average tax rates are calculated by dividing the total tax levy ($) by the total valuation taxable ($100) for the general tax rate and by the equalized valuation ($100) for the equalized tax rate. During the period, both general and equalized property tax rates have been decreased regardless of the type of local government. As indicated, the general tax rate is less useful in comparing tax rates among communities or over a period of time because of varying equalization ratios. Therefore, we focus on equalized tax rates in examining the trend and the relative importance of each type of local government.

The average annual percentage changes in counties', municipalities', and school districts' equalized tax rates are -4.8%, -5.0%, and -5.4%, respectively. The largest of the property tax rates on a statewide basis has always been the school district tax rate, constituting, on average, about 55% of the total tax rate. Starting in 2000 at $1.323, the school district tax rate dropped to $0.908 by 2007. The municipal tax rate is second in magnitude among the components. On average, the municipal tax rate's share of the total tax rate is almost 26%. The municipal tax rate declined from $0.636 in 2000 to $0.436 in 2007. The equalized property tax rate for counties has taken the least share of total tax rate, about 19%. The county tax rate has gradually decreased from $0.470 in 2000 to $0.314 for 2007.

Table 3-14. Property Tax Rates by the Type of Local Government (2000-2007)

Year	2007	2006	2005	2004	2003	2002	2001	2000
General Tax Rates ($)								
Total	2.651 (-5.6%)	2.808 (-4.2%)	2.930 (-3.0%)	3.021 (-0.2%)	3.027 (-0.5%)	3.043 (0.7%)	3.023 (0.6%)	3.003 (1.8%)
County	0.501 (-5.8%)	0.532 (-4.4%)	0.556 (-3.6%)	0.577 (-1.1%)	0.583 (-2.1%)	0.596 (1.4%)	0.588 (1.0%)	0.582 (0.4%)
Municipality	0.705 (-3.9%)	0.733 (-2.8%)	0.754 (-2.1%)	0.771 (0.1%)	0.770 (-0.6%)	0.774 (-0.9%)	0.782 (-0.5%)	0.786 (1.1%)
School District	1.446 (-6.3%)	1.543 (-4.7%)	1.619 (-3.3%)	1.674 (0.03%)	1.674 (0.1%)	1.673 (1.2%)	1.653 (1.1%)	1.636 (2.6%)
Equalized Tax Rates ($)								
Total	1.664 (-1.3%)	1.687 (-6.6%)	1.806 (-7.6%)	1.955 (-6.7%)	2.094 (-5.8%)	2.223 (-3.9%)	2.314 (-4.8%)	2.429 (-2.6%)
County	0.314 (-1.6%) (18.9%)	0.319 (-6.8%) (18.9%)	0.343 (-8.1%) (19.0%)	0.373 (-7.6%) (19.1%)	0.403 (-7.3%) (19.2%)	0.435 (-3.2%) (19.6%)	0.450 (-4.4%) (19.4%)	0.470 (-3.9%) (19.4%)
Municipality	0.436 (0.5%) (26.2%)	0.434 (-5.3%) (25.7%)	0.458 (-8.1%) (25.4%)	0.498 (-6.4%) (25.5%)	0.532 (-5.9%) (25.4%)	0.566 (-5.5%) (25.5%)	0.598 (-5.9%) (25.8%)	0.636 (-3.2%) (26.2%)
School District	0.908 (-2.1%) (54.6%)	0.927 (-7.1%) (54.9%)	0.998 (-7.9%) (55.3%)	1.083 (-6.5%) (55.4%)	1.158 (-5.3%) (55.3%)	1.222 (-3.4%) (55.0%)	1.266 (-4.4%) (54.7%)	1.323 (-1.8%) (54.5%)

Source: NJ DLGS (2000-2007a).

Notes: Annual change and proportion of each local government are in parentheses by order.

3-3-5. Property Tax Collection

The final step in the property tax administration process is the collection of property taxes. After the property tax rate is determined by the county board of taxation, the tax rate is reported to each municipality, which is responsible for collecting property taxes. After collecting property taxes, the municipal government distributes the property tax revenues to counties, school districts, and other special districts.

For the purpose of collecting property taxes and other revenues, a municipal tax collector must be appointed by the governing body of each municipality for a four-year term of office. The municipal tax collector must have the designation of certified tax collector for a permanent appointment (Benecke, 2004a). The municipal tax collector is prohibited by law from also serving as a member of the governing body and is subject to control by the Division of Local Government Services (NJ OLS, 2005). The main responsibilities of the municipal tax collector are to ascertain the amount of taxes due from each taxpayer and inform each of them, to receive and account for tax payments, to report periodically on the state of municipal finances, and to enforce timely payment of taxes by the taxpayer (New Jersey Division of Taxation, 2001; Pareti, 2001).

Table 3-15 compares property tax collections by the type of local government, indicating as well the annual percentage change and the share which each type of government partakes of the total tax levies. The total property tax levy increased from $14,195,070 in 2000 to $22,130,902 in 2007. During this period, counties, municipalities, and school districts annually increased their property tax levies by 5.8%, 6.5%, and 6.5%, respectively. In relative importance by type of local governments, 55 % of property tax revenue is distributed to local school districts, 26% to municipalities, and 19% to county governments, on average. The share of each government has been almost constant during this period.

The statewide aggregate comparison of property tax collections by the type of local government sheds light on the governments to be affected by changes in property taxes involving limits on tax levies, or assessed valuation changes. Table 3-15 shows that school districts would be affected most by such changes. Table 3-15 also provides the cause of decreases in equalized property tax rates. During this period, while the equalized tax rates has decreased (see Table 3-14), equalized property values (see Table 3-13) and property tax levies (Table 3-15) have increased. This indicates that decreases in equalized property tax rates are not caused by decreases in the amount of money financing local public goods, but by increases in the property tax base, the property values.

Table 3-15. Property Tax Collections by the Type of Local Government (2000-2007)

Year	2007	2006	2005	2004	2003	2002	2001	2000
Total	22,130,902 (5.8%)	20,914,762 (6.9%)	19,567,777 (6.5%)	18,377,494 (6.5%)	17,253,985 (7.6%)	16,035,254 (7.0%)	14,991,991 (5.6%)	14,195,070 (4.9%)
County	4,179,318 (5.5%) (18.9%)	3,960,988 (6.6%) (18.9%)	3,716,557 (6.0%) (19.0%)	3,506,903 (5.5%) (19.1%)	3,324,450 (5.9%) (19.3%)	3,140,369 (7.8%) (19.6%)	2,914,074 (6.0%) (19.4%)	2,748,945 (3.4%) (19.4%)
Municipality	5,882,848 (7.7%) (26.6%)	5,459,896 (8.4%) (26.1%)	5,038,923 (7.5%) (25.8%)	4,686,968 (6.8%) (25.5%)	4,387,009 (7.5%) (25.4%)	4,079,641 (5.2%) (25.4%)	3,876,752 (4.4%) (25.9%)	3,713,573 (4.2%) (26.2%)
School District	12,068,737 (5.0%) (54.5%)	11,493,877 (6.3%) (55.0%)	10,812,297 (6.2%) (55.3%)	10,183,622 (6.7%) (55.4%)	9,542,525 (8.3%) (55.3%)	8,815,244 (7.5%) (55.0%)	8,201,165 (6.1%) (54.7%)	7,732,552 (5.7%) (54.6%)

Source: NJ DLGS (2000-2007a).

Notes: 1. Dollar amounts are in thousands. 2. Annual change and proportion of each local government are in parentheses by order.

3-4. Conclusion

In New Jersey, 21 counties, 566 municipalities, 616 school districts, and over 200 special districts are currently operating to provide public goods and services. Counties, mainly as administrative arms of state government, are responsible for elections, the judicial system, and county jails, among other services. While local school districts are responsible for only primary and secondary education, municipalities are responsible for a wide range of local public services such as police and fire protection, water, sewerage, garbage collection, etc. In addition, special districts also deliver a broad range of public services, including fire protection, water, sewerage, and garbage collection.

Local governments represent about 49% of total state-local expenditure in New Jersey. Financial responsibility for providing most public services is commonly shared between the state government and local governments. The review of government expenditure reveals that there is a general correspondence between the real assignment of service responsibilities and the theoretical suggestions for the assignment of functions among levels of governments, including economies of scale, economies of scope, proximity to beneficiaries, and so on.[34]

With a few exceptions, local governments are responsible for providing services benefiting local residents such as fire and police protection, housing and community development, sewerage, water, and waste management. These services are closely related to property. On the other hand, state government is responsible for services requiring large-scale infrastructure such as hospitals, highways, and public transit. In addition,

34. Stigler (1957), Musgrave (1959), Olson (1969), Oates (1972), Raimondo (1992), and Shah (1994), among others, suggest guidelines for assigning responsibilities providing public services among different layers of governments.

broader-based services, such as public welfare, health, and income maintenance, are more commonly the responsibility of state government.

To finance various services, local governments relied on their own source of revenues for more than 68% of total local revenues, on average, during the period from fiscal year 2003-04 through 2005-06. Own-source revenues essentially consist of property taxes, user charges and fees, and other miscellaneous revenues. The remaining 32% of total local revenues comes from transfers from state government. Property tax is the single largest source of revenue for counties, municipalities, and school districts, accounting for more than half of total local revenues combined.

However, the relative importance of each source of revenue differs by the type of local government. Although the reliance on the property tax differs by the type of local government, all types of local government derive a considerable portion of their revenue from the property tax. In addition, since 2000, the reliance on the property tax has increased, regardless of the type of local government. On the other hand, the reliance on state aid differs greatly by the type of local government. While school districts depend heavily on state aid, the share of state aid in counties and municipalities is relatively small. Municipalities also rely heavily on user charges and fees, although their share declined during the period examined.

In New Jersey, the property tax is the local tax, as the property is assessed and tax is collected at the municipal level for financing counties, municipalities, school districts, and some special districts. The municipality functions as the tax collector for other local governments. In New Jersey, the property tax is also considered both a residual tax and an *ad valorem* tax. The residual tax means that the amount to be raised by the property tax is the difference between the total budget and non-property tax revenues. The *ad valorem* tax means that each taxpayer shares the tax burden according to the proportion that his or her property bears to the total value of all property in the taxing district.

To ensure a fair property tax burden according to property value, the New Jersey Constitution and state statues mandate that all property should be taxed in a uniform way, at the same rate and assessment ratio within a taxing district, and that property should be valued as its true value. To estimate the true value, which is defined as market value by the state law, equalization, revaluation, and reassessment programs are performed in New Jersey.

To relieve the burden of local taxpayers and to alleviate the reliance of local government on the property tax, the state government imposes limits on increases in both total property tax levies and tax rates. Despite such state-imposed limits, the share of property tax in total local revenue has increased since year 2000. This is partly because cuts in state aid and balanced budget requirements have collectively forced local governments to become more self-reliant and thus to rely more on property taxes.

The examination of the property tax collections and the percentage which they represent of total revenues by the type of local government illustrates the importance of the property tax at the local level. The high burden on taxpayers, the local governments' high reliance on the property tax, and the high visibility of the property tax intensify taxpayers' and local officers' concerns with the property tax in the local budget decision. The property tax is the most important revenue source which New Jersey local governments can decide for themselves.

Chapter IV. Hypotheses, Research Models, and Data

This chapter derives hypotheses and develops empirical models examining the hypotheses, based on the review of theoretical and empirical literatures on competition among governments in Chapter II and on the understanding of the local government structure and the practice of property tax administration in New Jersey reviewed in Chapter III. Through the literature review in the Chapter II, it is concluded that there are both theoretical and empirical reasons to believe that local governments engage in competition regardless of what is the source of such competition and that, in general, competition does affect fiscal behaviors of local governments. Chapter III shows that New Jersey is a good empirical setting to test both inter- and intra-jurisdictional competition with its highly fragmented local government structure, diversity in institutions, and property tax base sharing among different types of local government.

In the first section, hypotheses, which are testable using data on local governments in New Jersey, are developed from theoretical predictions of inter- and intra-jurisdictional competition. Based on the theoretical models, the second section defines four different public markets in which local governments are assumed to compete with each other. The third section specifies two types of empirical models to test hypotheses: a spatial policy interdependency model for the presence of inter- and intra-jurisdictional competition; and panel or cross-sectional regression models for the effects of inter- and intra-jurisdictional competition on government performance. In specifying each empirical model, dependent and independent variables are identified and defined, and their empirical measurements are provided. The final section presents the source of data to be used for estimating the empirical models with descriptive statistics of variables.

4-1. Hypotheses

The primary purpose of this study is to investigate the presence of competition among governments and the effect on government performance, which is addressed in the remainder of this study. This section provides two sets of hypotheses drawn from theoretical and empirical analyses on inter- and intra-jurisdictional competition. The first set of hypotheses pertains to the presence of competition among governments and the second set of hypotheses focuses on the consequences of competition in terms of government performance. In addition, we develop hypotheses about the effect of local government consolidation on government performance.

4-1-1. Existence of Inter- and Intra-jurisdictional Competition

We develop hypotheses about the presence of inter- and intra-jurisdictional competition in property tax rate setting by New Jersey local governments. The New Jersey property tax system and its local government structure have several unique strengths for examining inter- and intra-jurisdictional competition. First, local governments in New Jersey have considerable autonomy to pursue their own policies although their purposes and scope of activities are controlled by the state legislature through authorizing legislation. Local governments can initiate any policies that promote the interests of their constituents and independently determine how they finance these policies. The high level of autonomy of local governments raises the possibility that local governments engage in competition.

Second, the property tax is the most important revenue source which New Jersey local governments can decide upon themselves and the property tax base is shared by municipalities, school districts, and counties. The co-occupancy of the property tax base provides us the opportunity to examine simultaneously both inter- and intra-jurisdictional competition. Third, because the property tax is the most visible among local fiscal policies, citizens can easily monitor what happens to property tax rates but have a harder time monitoring the quality of other fiscal policies. Therefore, it is highly likely that local governments compete with each other through property tax rates.

A. Intra-jurisdictional Competition

Intra-jurisdictional competition theory suggests that co-occupancy of a tax base between different levels of government or between co-equal taxing authorities generates a negative externality. If one government raises its tax rate, this reduces the tax base and thus the tax revenue of the other governments. Then, the other governments can respond either by reducing their tax rates or by reducing expenditures. Thus, the sign of a reaction by the other governments to a change in the tax rate of the government is ambiguous. Although the sign of the reaction is theoretically ambiguous, a clear empirical prediction of the theoretical analysis of intra-jurisdictional competition is the existence of interdependence in setting tax rates by governments sharing the same tax base.

New Jersey is a convenient empirical setting to test the intra-jurisdictional competition theory due to the property tax base sharing and to the coterminous jurisdiction among local governments. In New Jersey, the property tax is the main revenue source for local governments and the property tax base is co-occupied by municipalities, school districts, and counties. In addition, New Jersey local governments have the unique feature of coterminous jurisdiction. This means that although counties, regional school districts, and consolidated school districts govern more than one municipal jurisdiction, there are no partially overlapping boundaries among municipalities, school districts, and counties.

The relationship among these three local governments in setting property tax rates can be explained by the intra-jurisdictional competition theory. Although the municipality and the school district may cooperate or coordinate in setting property tax rates because of the low cost of cooperation or coordination, this also leads to interdependence in tax rates. As theoretical analyses on intra-jurisdictional competition suggest, it is likely that there is interdependence in setting property tax rates among municipalities, school districts, and counties. This study examines the presence of intra-jurisdictional tax competition in local property tax rate setting by testing the following two hypotheses:

H1: School district property tax rates have an impact on municipal property tax rates.
H2: County property tax rates have an impact on municipal property tax rates.

B. Inter-jurisdictional Competition

The underlying assumption of inter-jurisdictional competition theories is that governments consider their neighbors' tax rates when setting their own, and, therefore, compete at some level with their competitors for economic and /or political reasons. According to Tiebout, the tax competition theory, and the Leviathan hypothesis, the tax rate of a jurisdiction influences the size of the tax base in neighboring jurisdictions and consequently affects the budget constraints of other governments. As a result, a jurisdiction's tax rate indirectly affects the tax rates of neighboring jurisdictions, leading to interdependence in local fiscal policies.

The above prediction is drawn from the pure competitive case where there are an infinite or a large number of competitors. In strategic competition where there are a small number of jurisdictions, the same empirical prediction of interdependence in tax rate settings can be drawn. The strategic tax competition theory proposes that the tax rate in a jurisdiction is directly influenced by the tax rates in neighboring jurisdictions because the government in each jurisdiction considers the tax rates of other jurisdictions when setting its own tax rate. This strategic behavior of each government leads to the interdependency in tax rates among neighboring jurisdictions.

Yardstick competition theory also yields the same empirical prediction about interdependence in tax rates among neighboring jurisdictions. In the yardstick competition theory, it is assumed that citizen-voters use other governments' performances as yardsticks to evaluate their incumbents' performance and they decide their votes based on this comparative performance evaluation. If citizen-voters take into account tax rates in neighboring jurisdictions, incumbents are forced to consider tax rates in neighboring jurisdictions too and, thus, set their tax rates in line with those in neighboring jurisdictions due to a concern for reelection.

This study examines the above conclusion of interdependence in tax rates among governments using municipal property tax rates. Inter-jurisdictional competition theories do not provide the exact sign of the effect of competitors' tax rates on a given government's tax rate. Therefore, the main idea underlying all theories on inter-jurisdictional competition can be formalized and implemented empirically by examining the following hypothesis:

H3: Property tax rate of a municipality is affected by property tax rates of competing jurisdictions.

4-1-2. Effect of Competition on Government Performance

To specify hypotheses about the effect of competition on government performance, it is necessary to define government performance. The performance of local governments can be evaluated using a wide variety of performance indicators such as financial measures, efficiency measures, effectiveness measures, or responsiveness indices (De Borger and Kerstens, 2000; Dollery, Wallis, and Worthington, 2001). Due to the unavailability of reasonable data on inputs and outputs of local governments, most empirical studies have focused on financial measures such as debt ratios, level of tax rates, level of revenues, and level of expenditures.

Theoretical and empirical studies have explored the consequences of competition among governments with respect to various government performance or behavior. The conventional tax competition theory and the intra-jurisdictional competition theory have focused on the allocative efficiency implications of competition while the Leviathan hypothesis and the yardstick competition theory have investigated inter-jurisdictional competition in terms of technical efficiency. In addition, all theories of inter- and intra-jurisdictional competition have suggested the results of competition among governments in terms of levels of tax rates, revenues, and expenditures.

We define local government performance in terms of property tax rates, allocative efficiency, and technical efficiency. The property tax rate is selected because all theories provide a theoretical prediction about the effect of competition on tax rates but this prediction has been ignored in the empirical studies. The allocative efficiency and technical efficiency measures are selected to evaluate which theoretical perspective is correct among the competing inter-jurisdictional competition theories. While all theories of inter-jurisdictional competition predict that competition leads to lower tax rates, they have contrasting predictions about the effect of competition on government efficiency. Thus, to examine which theory is correct, we have to use an efficiency measure of local governments.

A. Effect of Inter-jurisdictional Competition

a. Effect on property tax rates

All theories of inter-jurisdictional competition have a common prediction that inter-jurisdictional competition lowers the levels of tax rates, tax revenues, and government expenditures. Oates (1972) suggests that local governments keep tax rates low to attract a mobile tax base. This intuitive assertion has been examined by numerous formal theoretical analyses, which is known as the conventional tax competition literature. In particular, using a formal theoretical model, Hoyt (1991) demonstrates that intensifying inter-jurisdictional competition by increasing the number of competing governments lowers tax rates.

The Leviathan hypothesis posits also that the degree of inter-jurisdictional competition is inversely related to the tax rate. In particular, Brennan and Buchanan (1980) argue that fragmentation of governmental units enhances inter-jurisdictional competition for mobile citizens or other mobile resources and this competition, in turn, reduces governments' taxing power. This prediction can be interpreted such that an increase in the number of governments in a public sector or a public market leads to lower tax rates. Formal theoretical analyses confirm the above intuitive assertions.

On the other hand, the yardstick competition literature is implicit regarding the effect of inter-jurisdictional competition on the tax rate. The yardstick competition theory suggests that citizen-voters' retrospective voting strategy based on relative performance evaluation induces local governments to engage in competition and to do better than other jurisdictions. Based on this argument it can be predicted that yardstick competition leads to lower tax rates if other things, especially expenditure levels, are equal. The theoretical prediction about the effect of inter-jurisdictional competition on tax rates is formalized into the following hypothesis, which is examined in terms of New Jersey property tax rates.

> H4. The degree of inter-jurisdictional competition is negatively related to the property tax rates.

b. Effect on allocative efficiency

Theories of inter-jurisdictional competition have contrasting views on the effects of competition on allocative efficiency. While Tiebout, the Leviathan hypothesis, and the yardstick competition theory predict that inter-jurisdictional competition leads to allocative efficiency, the conventional tax competition theory predicts that inter-jurisdictional competition results in allocative inefficiency. On the one hand, the conventional tax competition theory suggests that local governments keep tax rates low to attract mobile capital and this, in turn, leads to the under-provision of local public goods. Hoyt (1991), among others, confirms this intuitive idea by demonstrating that an increase in the number of jurisdictions in a public sector leads to a greater underprovision of public goods and thus to allocative inefficiency.

On the other hand, Tiebout, the Leviathan hypothesis, and the yardstick competition theory provide contrasting views on the allovative efficiency implication of inter-jurisdictional competition. Tiebout states that the ability of individuals to "vote with their feet" results in allocative efficiency in the provision of local public goods. The Leviathan hypothesis and the yardstick competition theory suggest that inter-jurisdictional competition can make self-interested politicians responsive and accountable to the public interest. While the effect of inter-jurisdictional competition on allocative efficiency was not examined in the formal theoretical analyses, the above argument broadly suggests that inter-jurisdictional competition leads to allocative efficiency. We address the question of which theoretical perspective is correct by testing the following hypothesis:

> H5: The degree of inter-jurisdictional competition has an impact on the allocative efficiency of local governments.

c. Effect on technical efficiency

While the Leviathan hypothesis and the yardstick competition theory have focused on the technical efficiency implication of inter-jurisdictional competition, the traditional tax competition theory has ignored it. The Leviathan hypothesis and the yardstick competition theory argue that inter-jurisdictional competition fosters increased efficiency in the production of local public goods. Formal theoretical analyses confirm this intuitive idea by demonstrating that inter-jurisdictional competition leads to technical efficiency by reducing government waste or rent. Tiebout also argues that citizen mobility combined with competition among governments increases productivity and reduces waste.

On the other hand, the conventional competition theory is silent about the technical efficiency implication of inter-jurisdictional competition. The theoretical analyses eliminate the technical efficiency issue by assuming that local governments are benevolent welfare maximizers and that they use identical production techniques. However, Oates (1972) provides a theoretical prediction about the effect of competition on technical efficiency in terms of economies of scale. According to him, by reducing jurisdiction sizes, increasing the number of local governments may result in the loss of economies of scale and thus technical inefficiency. The contrasting two theoretical perspectives on the technical efficiency implication of inter-jurisdictional competition are investigated by testing the following hypothesis:

H6: The degree of inter-jurisdictional competition has an impact on the technical efficiency of local governments.

B. Effect of Public Market Share

Asymmetric tax competition models provide an empirical prediction about the effect of jurisdictions' relative population sizes on tax rates. In particular, Bucovetsky (1991) and Wilson (1991) analyze the role of jurisdictions' relative population sizes in inter-jurisdictional competition. They predict that smaller or less populous jurisdictions compete by setting tax rates lower than those of their larger competing jurisdictions. Alternatively, relatively larger jurisdictions tend to have higher tax rates than smaller competing jurisdictions because the supply of capital to the larger jurisdictions is less responsive to their tax rate changes. To examine this prediction, this study tests the following hypothesis:

H7: Communities' relative population size to the total population of a public market is positively related to the property tax rate.

C. Effect of Local Government Consolidation

The consequences of local government consolidation can be explained by theories of inter-jurisdictional competition and economies of scale. First, Oates' (1972) economies of scale thesis can be applied to explain the effect of government consolidation on government performance. According to Oates, mergers of small units produce economies of scale. If economies of scale are present in the provision of local public services, then consolidation should be associated with lower tax rates and costs and greater productive efficiency. Cost savings may result from the removal of administrative duplication, from the lower input prices as a result of greater purchasing power, or from the use of sophisticated technical equipment when the appropriate scale threshold is reached (Boyne, 1992).

The conventional tax competition theory argues that inter-jurisdictional competition leads to sub-optimal levels of tax rates and, thus, to underprovision of local public goods. The tax competition theory suggests reducing the degree of inter-jurisdictional competition as the solution to the allovative inefficiency created by competition for mobile factors. Thus, from the perspective of the tax competition theory, the consolidation of small jurisdictions is expected to result in higher tax rates and to enhance allocative efficiency by reducing the intensity of inter-jurisdictional competition. Hoyt (1991) theoretically demonstrates that intensifying the degree of competition leads to lower tax rates and to underprovision of local public goods.

On the other hand, if average cost curves are 'U' shaped, then very large consolidated units may be subject to diseconomies of scale. In this case, higher costs may arise because of the problems of delivering services to remote areas or because of bureaucratic congestion (Boyne, 1992). In the beneficial view of inter-jurisdictional competition, consolidation may also lead to technical inefficiency. As stated above, consolidation reduces the intensity of inter-jurisdictional competition by reducing the number of competing governmental units. Therefore, from the perspective of Tiebout, the Leviathan hypothesis, and the yardstick competition theory, it is predicted that government consolidation leads to higher tax rates and technical inefficiency.

The variation in types of New Jersey school districts provides us an opportunity to examine the contrasting predictions about the effects of local government consolidation. As we saw in Chapter III, New Jersey local school districts are classified into regular, regional, and consolidated school districts. Consolidated school districts are formed through the merger of two or more municipalities into a single school district. The theoretical prediction on local government consolidation can be empirically examined by comparing tax rates, allocative efficiency, and technical efficiency between communities who are members of a consolidated school district and communities with regular school districts.

H8: There is a systematic difference in tax rates between communities which are members of a consolidated school district and communities with regular school districts.

H9: There is a systematic difference in allocative efficiency between communities which are members of a consolidated school district and communities with regular school districts.

H10: There is a systematic difference in technical efficiency between communities which are members of a consolidated school district and communities with regular school districts.

D. Intra-jurisdictional Competition vs. Budget Referendum

The equilibrium analyses on intra-jurisdictional competition have examined the allocative efficiency implication of intra-jurisdictional competition by comparing the equilibrium tax levels of overlapping governments with those of unitary or coordinated cases. The results of equilibrium analyses generally show that an increase in taxes by one level of government results in a reduction in revenue to the other level of government. This negative vertical externality causes one level of government to underestimate the social marginal cost of raising tax revenue from the common tax base, since it ignores the impact on others of choosing its tax rate. This, in turn, makes both levels of government set a higher total tax rate on the shared tax base than they would if it was only taxed by one level of government or a coordinated one. Consequently, the equilibrium analyses conclude that intra-jurisdictional competition results in the super-optimal level of public goods provision.

In New Jersey, the relationship between the Type I school district and the municipality in fiscal policy decision making can be regarded as the coordinated case in the theoretical analysis of the equilibrium tax levels. In a Type I school district, the annual budget is prepared by the board of education whose members are appointed by the mayor. The budget is submitted for approval to the board of school estimate which consists of the mayor, two members of the school board, and two members of the municipal governing body. On the other hand, the annual school budget must be approved by citizen-voters in Type II school districts. The legal type of school districts, therefore, reflects two different institutions: the budget referendum as a form of direct democracy and intra-jurisdictional competition.

Direct democracy institutions have been touted as the means of controlling politicians who tend to pursue their own interests in a representative democracy. The central theoretical argument on direct democracy is that it provides citizens with a means of selectively controlling their representatives on specific policies when such policies deviate sufficiently far from citizens' preferences (Freitag and Vatter, 2006). Several studies have examined whether governments with the initiative or the referendum demonstrate a stronger relationship between citizen preferences and policy output. In general, the majority of the studies provide evidence for supporting the theoretical prediction at the local and state level in Switzerland and the U.S, showing that direct democracy institutions reduce government taxes, expenditures, and debt (for example, Santerre, 1986; Matsusaka, 1995; Feld and Kirchgässner, 2001; Schaltegger and Küttel, 2002).

We can empirically examine the two theoretical predictions of intra-jurisdictional competition by comparing tax rates and allocative efficiency between communities with Type I school districts and communities the Type II school districts. However, the budget referendum and intra-jurisdictional competition have contrasting effects both on tax rates and on allocative efficiency. Considering these two contrasting effects, we draw the following two conditional hypotheses:

H11: Property tax rates are lower in communities with Type II school districts if the budget referendum effect outweighs the intra-jurisdictional competition effect. On the other hand, property tax rates are higher in communities with Type II school districts if the intra-jurisdictional competition effect dominates the budget referendum effect.

H12: Allocative efficiency is higher in communities with Type II school districts if the budget referendum effect outweighs the intra-jurisdictional competition effect. On the other hand, allocative efficiency is lower in communities with Type II school districts if the intra-jurisdictional competition effect dominates the budget referendum effect.

4-2. Definition of Public Market

One main purpose of this study is to examine arguments about the presence and the effects of competition from theoretical analyses of inter-jurisdictional competition. To empirically test the presence and the effects of inter-jurisdictional competition, it is required to assign neighbors or competitors to a given government by defining a public market in which inter-jurisdictional competition is assumed to take place. However, theories are silent about the proper definition of the public market and empirical studies lack a consistent definition of the public market. We may draw quite different conclusions on the existence and the effect of inter-jurisdictional competition by using different definitions of the public market. Therefore, on the basis of theoretical arguments, empirical feasibility, and empirical supports, this study defines the public market using several criteria including contiguity, geographic distance, and county jurisdictional boundaries.

4-2-1. Public Markets in Previous Empirical Studies

Theories on inter-jurisdictional competition are silent about how to properly define a public market in which local governments are assumed to compete or interact with each other. Therefore, it is clear that, in empirical studies, the choice of criteria for defining the public market is somewhat arbitrary. Empirical studies on inter-jurisdictional competition define the public market based on various criteria such as contiguity, geographic distance, socio-economic similarity, or geo-political boundary. Reviewing the definition of a public market in empirical studies reveals that there is a systematic difference in defining the public market between studies on the presence of inter-jurisdictional competition and those on the effect of it.

Most empirical studies on the effect of competition define public markets as fixed geo-political boundaries such as counties (Eberts and Gronberg, 1988; Deller, 1990; Hughes and Edwards, 2000; Bates and Santerre, 2006), SMSAs (Forbes and Zampelli, 1989; Schneider, 1989; Zax, 1989; Eberts and Gronberg, 1990; Grossman et al., 1999; Bates and Santerre, 2006; Stansel, 2006), and states or provinces (Oates, 1985; Nelson, 1987; Hayes et al., 1998). One exception is Schneider (1989) who also defines the public market based on contiguity. In these studies, all other governments within the same fixed public market are assigned to a given government as its competitors. While some studies (Nelson, 1987; Eberts and Gronberg, 1988 and 1990; Zax, 1989; Stansel, 2006) distinguish between general-purpose and special-purpose governments, other studies assume that all governmental units within a public market compete with each other, regardless of the type and the level of government.

On the other hand, empirical studies on the existence of inter-jurisdictional competition, which use spatial regression techniques, generally define the public market as one which varies by government using geographic proximity criteria such as contiguity or geographic distance. In these studies, a given government is assumed to compete with other governments which share the same border with or locate within a certain distance from the given government. Like empirical studies on the effect of inter-jurisdictional competition, several studies define public markets as fixed geo-political boundaries such as SMSAs (Ladd, 1992), statistical regions (Schaltegger and Küttel, 2002), and Cantons (Brülhart and Jametti, 2006). In addition, some studies also use a fixed public market which is defined by socio-economic similarity, regardless of geographic proximity (for example, Schaltegger and Küttel, 2002; Hernández-Murillo, 2003; Solé-Ollé, 2003).

While the geographic area of a public market defined by geographic proximity differs by community, the geo-political boundary-based public market is a fixed geographic area. In addition, the geographic area of geo-political boundary-based public market is much larger and, thus, the number of participants in the public market is larger than that in the geographic proximity-based public market. This means that, while empirical studies on the existence of competition have examined strategic competition among a relatively small number of governments, the empirical literature on the effect of competition, especially the Leviathan literature, has investigated the effect of relatively pure competition among a large number of governments.

4-2-2. Four Different Definitions of Public Market

After reviewing theoretical models and empirical studies, and considering empirical feasibility, this study defines the public market using four criteria: the first-order contiguity, the second-order contiguity, the geographic distance, and the county jurisdictional boundary. Based on the four different definitions of the public market, this study calculates the average property tax rates of neighbors or competitors to test the existence of inter-jurisdictional competition and measures the degree of inter-jurisdictional competition to examine the effect of inter-jurisdictional competition on government performance. In the following, how the public market is defined using the four criteria is explained and theoretical rationales for each definition of the public market are provided.

The simplest criterion to define the public market is the first-order contiguity. Based on this criterion, municipalities are competitors of a given municipality if they share a common border with the given municipality. The second-order contiguity assigns municipalities sharing a common border with the first-order competitors to a given municipality as its competitors. The second-order contiguity is cumulative and, thus, includes all the first-order competitors as well. The geographic distance criterion defines competitors based on the distance between centroids of municipalities. In a distance-based public market, competitors are defined as municipalities located within a minimum distance, which is required to assure that each municipality has at least one competitor. The last criterion is the county boundary, which defines competitors of a municipality as all other municipalities within the same county jurisdiction.

The definition of the public market should be driven by the theoretical models. In mobility-based theories (Tiebout, tax competition, and Leviathan hypothesis), the mobility of citizens, business firms, and other production factors is the central mechanism which induces governments to compete with each other. On the other hand, the yardstick competition theory suggests that competition derives from the comparative evaluation of performance by citizen-voters. In this mechanism, information flow is crucial for citizen-voters to evaluate their own government's performance relative to that of other governments. Therefore, the validity of criteria for defining the public market is evaluated in terms of ease both of citizen mobility and of information flow.

The geographic proximity criteria, including contiguity and geographic distance, have been used most frequently in the empirical studies on inter-jurisdictional competition. Where mobility-based competition is concerned, geographic proximity seems to be a reasonable a criterion to define the public market. When citizens are dissatisfied with policies of their government, they may move to a more preferable local government. Changing local government incurs emotional, social, informational, and economic costs and these costs are proportional to the geographic distance (Eberts and Gronberg, 1988; Schneider, 1989). Therefore, the mobility of residents which induces local governments to engage in competition seems to occur among geographically close jurisdictions. One other rationale for the use of geographic proximity is that adjacent jurisdictions are more likely to experience similar economic shocks (Bordignon et al., 2003) and, thus, information on policies of near-by jurisdictions may be a more informative yardstick to citizen-voters (Vermeir and Heydels, 2006). In addition, information about policies in nearby jurisdictions is more easily available to citizen-voters because it is spread mainly through local and regional newspapers. Geographic proximity, therefore, seems to be the appropriate criteria to account for both citizen mobility and information flow.

The county has been treated as an appropriate geographic unit of the public market because it is regarded as the political division that most reasonably approximates the principal local labor and housing markets for residents within the county (Baird and Landon, 1972; Zax, 1989).[35] In New Jersey, it seems that the geographic boundary of a county is large enough for residents to choose their residential location but small enough to allow changes in local public services and property taxes without changes in workplace location or social circles. In addition, on their websites, county governments

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35. According to U.S. Census Bureau (2001), 43.4 million Americans changed their place of residence between March 1999 and March 2000. While only 8.8 million (20.3%) of those who moved during that year moved to a different county within the same state and 8.4 million (19.4%) moved across state lines, 26.2 million (60.4%) chose to remain within the same county.

also provide property tax, public services, and other information on each municipality in the county, which may be used by citizen-voters and municipal officials. Therefore, using the county as a unit of public market is justified in terms of both resident mobility and information flow.

In addition to the geographic proximity and geo-political boundary, it is also reasonable to define the public market based on similarity in demographics or economic conditions. In practice, several studies have defined the public market based on socio-economic similarity in examining the presence of inter-jurisdictional competition. However, this study does not use the socio-economic similarity-based public market mainly due to the difficulty in empirically implementing the definition. Using statistical methods such as Q-methods, cluster analysis, or factor analysis, it is possible to categorize municipalities into a small number of groups which have similar socio-economic conditions. However, this is very difficult when the number of observations is substantially large. In addition, it is proved that in the empirical literature, geographic proximity criteria performs better than socio-economic similarity criteria (Revelli, 2003).

4-2-3. Empirical Implementation

With a map of New Jersey, this study assigns competitors to each municipality using the spatial econometric software, GeoDa^{TM}. The distance-based public market is defined by Euclidean distance between centeroids of municipalities in a polygon map and the minimum Euclidean distance is 36,901.48. Table 4-1 provides descriptive statistics on the number of competitors by public market. It shows that the number of competitors in the geographic proximity-based public market, on average, is much smaller than that in the public market defined by the county boundary.

The difference in the number of competitors between different definitions of public market has important implications for understanding inter-jurisdictional competition. Regardless of the underlying mechanism, inter-jurisdictional competition can be classified into purely competitive competition and strategic competition by the number of participants in the public market. Strategic competition takes place among either two or a small number of governments and pure competition occurs among a large or infinite number of governments.

Although both the theoretical and the empirical studies do not provide a critical number of competitors to distinguish between purely competitive competition and strategic competition, competition in the first-order contiguity-based public market may be regarded as a strategic competition and competition in the county boundary-based public market may be treated as a pure competitive case, in relative terms.

Table 4-1. Number of Competitors by Public Market

Public Market	Mean	Min (N of Observation)	Max (N of Observation)
First-order Contiguity	5.035	1 (32)	15 (1)
Second-order Contiguity	12.664	3 (4)	29 (2)
Euclidean Distance	16.311	1 (8)	51 (2)
County Boundary	33.216	11 (12)	69 (70)

4-3. Research Models

The previous section developed hypotheses about the presence and the effect of inter- and intra-jurisdictional competition. This section is devoted to specifing several empirical models for examining the hypotheses, i.e., a spatial tax rate setting model for the presence of competition, a combined municipal-school district tax rate model for the effect of competition on property tax rates, a hedonic property value model for the effect of competition on allocative efficiency, and a Tobit regression model for the effect of competition on technical efficiency.

4-3-1. Existence of Competition

The spatial tax rate model is developed to simultaneously examine the presence of intra-jurisdictional competition between municipalities and school districts (Hypothesis 1) and between municipalities and counties (Hypothesis 2) and inter-jurisdictional competition among municipalities (Hypothesis 3) in setting property tax rates. For this purpose, this study proceeds with two steps in developing the empirical analysis. First, we develop a non-spatial municipal tax rate model, which includes only intra-jurisdictional competition terms and control variables. Second, based on a spatial autocorrelation test on OLS residuals of the non-spatial municipal tax rate model, we identify and specify the proper spatial model between a spatial error model and a spatial lag model. Following the model specification, we present the measurement of variables and the empirical implementation strategy. Finally, we consider the econometric issues of estimating the spatial tax rate models and provide solutions to these issues.

A. Municipal Property Tax Rate Model

We start with the non-spatial tax rate setting model relating municipal property tax rates to school district property tax rates, county property tax rates, and other control variables. Because theory provides no specific functional form, the natural starting point is a linear additive specification. The non-spatial tax rate setting model can be expressed as follows:

$$MTR_{it} = \beta_0 + \beta_1 STR_{it} + \beta_2 CTR_{it} + X_{it-k}\theta + u_{it}\,, \qquad (1)$$

where the subscripts *i, t,* and *k* represent the municipality ($i = 1, \ldots, 566$), year ($t = 2004$), and a time lag ($k = 0$, 1, or 4), respectively. MTR_{it}, STR_{it}, and CTR_{it} are the property tax rates of municipalities, school districts, and counties, respectively. X_{it-k} denotes a group of exogenous control variables, and u_{it} refers to an error term.

If the OLS residuals of the non-spatial tax rate setting model (Equation 1) exhibit a significant spatial lag dependence or a spatial error dependence, the non-spatial tax rate setting model would be mis-specified and, thus, should be specified either as a spatial lag model or as a spatial error model (Anseline, 1988). The spatial lag tax rate setting model and the spatial error tax rate setting model can be expressed as follows:

$$MTR_{it} = \beta_0 + \beta_1 STR_{it} + \beta_2 CTR_{it} + \beta_3 \sum_{i \neq j} w_{ijt} MTR_{jt} + X_{it-k}\theta + \varepsilon_{it}\,, \qquad (2)$$

$$MTR_{it} = \beta_0 + \beta_1 STR_{it} + \beta_2 CTR_{it} + X_{it-k}\theta + u_{it}\,,\ u_{it} = \sum_{i \neq j} \lambda w_{ijt} u_{jt} + \varepsilon_{it}\,, \qquad (3)$$

where subscript j denotes the competitors of a given municipality i, $\sum_{i \neq j} w_{ijt} MTR_{jt}$ represents a spatially lagged dependent variable, $\sum_{i \neq j} \lambda w_{ijt} u_{jt}$ refers to a spatially lagged error term, and ε_{it} is a well behaved error term.

The spatial lag model (Equation 2) and the spatial error model (Equation 3) seem to be similar but, in fact, they have quite different predictions about the behavior of governments in setting their tax rates.[36] The spatial lag model posits that the tax rate of a given municipality is influenced by the tax rates of competing municipalities and by other determinants. The spatial lag model, therefore, is consistent with the arguments from inter-jurisdictional competition theories. On the other hand, the spatial error model implies that tax rate determinants omitted from the model are spatially correlated and this leads to a spatial dependence in the dependent variable. Consequently, the spatial error model suggests that there is no inter-municipal competition in setting tax rates.

What are the consequences of ignoring the spatial dependence in the dependent variable or in the error term? Even when there is no spatial dependence in the dependent variable, the estimation of the spatial lag model can lead us to conclude that there is competition if the error term is spatially autocorrelated. In addition, ignoring the spatial autocorrelation in the error term does not affect the unbiasedness of the estimated parameters of β_1, β_2, and θ, but it reduces their efficiency (Hernández-Murillo, 2003). On the other hand, ignoring the spatial dependence in the dependent variable causes a more serious problem. When there is a spatial autocorrelation in the dependent variable, omitting the spatially lagged dependent variable in estimating the model yields inconsistent estimates of β_1, β_2, and θ (Brueckner, 2003). This suggests the importance of careful examination of spatial autocorrelation in the dependent variable and in the error term.

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36. The spatial lag model has been used interchangeably with several different names such as spatial autoregressive model and spatially lagged dependent model in the spatial econometric literature. We use the term, spatial lag model, throughout this study.

a. Municipal, school district, and county tax rates

To examine the presence of inter- and intra-jurisdictional competition in setting property tax rates, this study estimates the non-spatial tax rate setting model (Equation 1) and the spatial tax rate setting models (Equation 2 and 3), which link municipal property tax rates to school districts' and counties' tax rates and/or to competing municipalities' tax rates. As a result, the most important exploratory variables are the property tax rates of school districts (STR_{it}), counties (CTR_{it}), and competing municipalities ($\sum_{i \neq j} w_{ijt} MTR_{jt}$). The property tax rates are measured by the effective or equalized property tax rate and stated dollars per \$100 of assessed property value. The equalized property tax rate is calculated as follows:

$$\text{Equalized Property Tax Rate} = \frac{\text{Total Property Tax Levy}}{\text{Total Equalized Property Value}} \times \$100$$

The effective property tax rate is calculated by dividing the property tax levy for each type of local government by the total equalized property value in the municipality. The property tax levy is the amount of money required to be raised through property taxation. The property tax levy is determined by subtracting anticipated revenues from other sources from the total appropriations in the budget. The equalized property value is the market value, which is found through a massive statistical program by the Division of Taxation. When comparing tax rates between communities or over a period of time, the equalized tax rate is more useful than the general tax rate, which is used to calculate the property tax bill.

b. Spatially lagged dependent variable

The spatially lagged dependent variable ($\sum_{i \neq j} w_{ijt} MTR_{jt}$) is the average municipal property tax rate of competitors. While there is a unique match between a county and municipalities within its jurisdiction and between a municipality and a school district according to their respective geographic location, it is required to define a criterion in order to assign a set of competitors to each municipality. In the second section of this chapter, we define competitors based on four criteria: first-order contiguity, second-order contiguity, Euclidean distance, and county jurisdictional boundary.

These four criteria are implemented by constructing a spatial weights matrix $\boldsymbol{W} = \{w_{ijt},\ i,j = 1, \ldots, 566,\ t = 2004\}$, where w_{ijt} is 1 for municipality j that is assigned as a competitor to a municipality i according to the predefined four criteria and 0 otherwise. The weights matrix $\boldsymbol{W}$ is row-standardized so that the sum of the weights equals unity for each municipality i. Therefore, a spatially lagged dependent variable ($\sum_{i \neq j} w_{ijt} MTR_{jt}$) for each municipality i is the simple average tax rate of competing municipalities, and a spatially lagged error term ($\sum_{i \neq j} \lambda w_{ijt} u_{jt}$) for each municipality i is the average value of the error term of its neighbors. In the tables of spatial regression outputs, the simple average tax rate of competitors ($\sum_{i \neq j} w_{ijt} MTR_{jt}$) is denoted by $\boldsymbol{W}MTR_{it}$.

It can be argued that it is better to give different weights to competitors by distance or by their socio-economic characteristics.[37] However, we give equal weights to all competitors of a given municipality and use the simple average tax rate of competing

37. For example, Brueckner and Saavedra (2001), Buettner (2003), and Luna (2004) give different weights to competitors by population size, revenue or expenditure size, or income level.

municipalities, based on the following rationale. Theories on inter-jurisdictional competition posit that politicians consider competitors' tax rates when setting their own tax rates and that citizen-voters use neighboring jurisdictions' tax rates as a yardstick to evaluate their government's performance. In doing this, politicians and citizens are not likely to give different weights on the tax rates of competitors by the socio-characteristics of competing jurisdictions or distance. Rather, it is more feasible that politicians and citizens simply either consider a competing jurisdiction's tax rate or disregard it.

c. Determinants of municipal property tax rates

A local government's fiscal decisions are influenced by its demographic and economic environment, its fiscal capacity, and its political institutions. These factors are grouped in the matrix X_{it-k}. The inclusion of various control variables serves to determine the robust influence of the independent variables on the municipal property tax rates (MTR_{it}). These control variables are selected based on the theoretical and empirical literature on the determinants of local fiscal policy. The shorthand name, the definition, and the empirical measurement of control variables are as follows:

$PMTL_{it-1}$	: Municipal property tax levy per capita = Total property tax levy for municipal purposes ($1,000) ÷ Estimated population;
$PMSA_{it-1}$	: State aid to municipality per capita = Total state formula aid to municipality ($1,000) ÷ Estimated population;
POP_{it-1}	: Municipal population = Estimated population as of July 1 (1,000 persons);
$POPS_{it-1}$	: Square of estimated population;
$POPD_{it-1}$	: Municipality population density = Estimated population (1,000 persons) ÷ Land area (square mile);
INC_{it-1}	: Personal income = Total personal income ($1,000) ÷ Number of taxpayer plus dependents;
POV_{it-1}	: Poverty rate = Number of children aged 5-17 receiving Temporary Assistance for Needy Families (TANF) ÷ Estimated population (1,000 persons);

RBP_{it-1} : Residential building permits = Total number of new residential units authorized for construction;

UER_{it-1} : Unemployment rate = Estimated number of unemployment $\div$ Estimated number of labor force $\times$ 100;

$P65_{it-4}$: Percent of population aged 65 or over in 2000 = Number of population aged 65 or over $\div$ 2000 census population $\times$ 100;

PBA_{it-4} : Education level = Number of population over age 25 with a bachelor's degree (BA) or higher in 2000 $\div$ 2000 census population $\times$ 100;

PAA_{it-4} : Percent of African-American population in 2000 = Number of African-American $\div$ 2000 census population $\times$ 100;

PHO_{it-4} : Percent of home ownership in 2000 = Total number of owner-occupied units $\div$ Total number of occupied units $\times$ 100;

CRI_{it-4} : Crime rate = Total number of offenses reported in 2000 $\div$ 2000 census population $\times$ 1,000;

DD_{it} : Direct democracy institution = Dummy (1 if municipality has initiative and/or referendum and 0 otherwise);

$CONSOL_{it}$: Member of a consolidated school district = Dummy (1 if a community is a member of a consolidated school district and 0 otherwise);

$INTRA_{it}$: Relationship between municipalities and school districts = Dummy (1 if a school district is a Type II school district and 0 otherwise);

$FMG1_{it}$: Elected governing body and chief executive form of municipal government = Dummy (1 if both governing body and chief executive are elected by voters and 0 otherwise); and

$FMG2_{it}$: Elected governing body-administrator form of municipal government = Dummy (1 if a municipality operates under township, village, or commission form and 0 otherwise).

The property tax rates depend on the level of revenues necessary for financing local public services. As shown in Chapter III, the property tax is levied to support the residual costs of local governments after all other revenue sources have been anticipated. To control for the amount of money to be raised through property taxes, we include municipal property tax levy ($PMTL_{it-1}$). We expect the property tax levy to have a positive impact on municipal tax rates because a higher tax rate is needed to support greater expenditures.

To control for other sources of revenue, we include state aid to municipalities per capita ($PMSA_{it-1}$). Intergovernmental transfers have been found to have an impact on the fiscal behavior of recipient governments. The literature suggests that grants-in-aid increase the spending of the recipient government (Gramlich, 1977; Inman, 1979; Dye, 1990) and reduce tax levels but not as much as in spending (Wildasin, 1986; Dye, 1990; Raimondo, 1992; Fisher and Papake, 2000). State aid to municipalities allows municipalities to reduce property tax rates and, thus, is expected to have a negative effect on municipal tax rates.[38]

Population (POP_{it-1}) and population density ($POPD_{it-1}$) are included to capture the potential economies of scale in providing local public services. The sign of the coefficients of these variables is ambiguous since it depends on whether or not scale economies exist in providing local public services. If scale economies are present, population and population density are expected to have negative impacts on municipal tax rates. We also include squared population ($POPS_{it-1}$) to allow for a non-linear relationship between population and municipal tax rates. The squared population can have either a negative or a positive impact on municipal tax rates.

Population structure variables are included to capture their impacts on the demand for local public services and, thus, on municipal tax rates. The population structure

38. Other revenue sources are certainly important in a municipality's tax decisions. Other than the property tax levy and the state aid, we consider per capita municipal expenditures and per capita miscellaneous revenues. We omitted expenditures and miscellaneous revenues due to severe multicollinearity. Pearson's correlation coefficients show that these variables are highly correlated with property tax levies and with state aid. The correlation coefficients are as follows:

	Tax Levy	State Aid	Expenditures
State Aid	0.923		
Expenditures	0.999	0.936	
Miscellaneous Revenues	0.994	0.950	0.998

Notes: All Coefficients are significant at .01 significance level.

variables are the poverty rate (POV_{it-1}), the percent of those aged 65 or more ($P65_{it-4}$), the percent of African-Americans in the population (PAA_{it-4}), the percent of homeowners (PHO_{it-4}), the education level (PBA_{it-4}), and the crime rate (CRI_{it-4}). These variables also represent the fiscal capacity or economic wealth of municipalities. The poverty rate, the percentage of senior people, the percentage of African-Americans, and the crime rate are expected to have positive effects on municipal tax rates because they present a high demand for public services and weak fiscal capacities. The others can have either negative or positive effects on municipal tax rates since they represent a high demand for public services and strong fiscal capacities.

To control for the economic condition and the fiscal capacity of a municipality, we include the unemployment rate (UER_{it-1}), personal income (INC_{it-1}), and residential building permits (RBP_{it-1}). Since total property value increases with new construction, the residential building permit is expected to exert a negative effect on municipal tax rates. Personal income and the unemployment rate may also reflect a high demand for municipal services. The unemployment rate is expected to have a positive effect since it represents a high demand for public services and weak fiscal capacity. Personal income may have either a positive or a negative effect because it a reflects high demand for public services and strong fiscal capacity.

A local government's political institutions also influence its fiscal decisions. To characterize the municipal political environment, we include a dummy variable for municipalities with a direct democracy institution (DD_{it}) and dummy variables for forms of municipal government ($FMG1_{it}$ and $FMG2_{it}$). To capture the differences in the relationship between municipal governments and school districts, we also include a dummy variable for municipalities which are a member of a consolidated school district ($CONSOL_{it}$) and a dummy variable for municipalities with a Type II school district ($INTRA_{it}$). We have no prior expectation on the sign of the coefficients associated with these political institutional variables.

B. Hypothesis Test

a. Intra-jurisdictional competition

As we saw in the Chapter III, the main revenue source of local governments in New Jersey is the property tax and the property tax base is shared among municipalities, school districts, and counties. This tax base co-occupancy among three types of local governments is exactly the case which is examined in intra-jurisdictional competition theory. Thus, it is hypothisized that municipal property tax rates are affected by school district tax rates (Hypothesis 1) and county tax rates (Hypothesis 2).

Since the direction of one government's reaction to the changes in tax rate of the other governments is theoretically ambiguous, Hypothesis 1 and Hypothesis 2 are tested by examining the statistical significance of the coefficients on the school district tax rates (β_1) and the county tax rates (β_2), respectively. In addition, the relationship between intra- and inter-jurisdictional competition can be investigated by the changes in the statistical significance and the magnitude of the coefficients on the school district tax rates (β_1) and the county tax rates (β_2) between the non-spatial tax rate setting model (Equation 1) and the spatial tax rate setting models (Equation 2).

b. Inter-jurisdictional competition

Although mobility-based theories (Tiebout, the tax competition theory, and the Leviathan hypothesis) and the information-based yardstick competition theory provide different mechanisms whereby local governments are induced to compete with each other, they have in common a prediction that the tax rate of a jurisdiction is influenced by its neighboring or competing jurisdictions' tax rates. Based on the theoretical argument, we set the Hypothesis 3 that the property tax rate of a municipality is affected by the property tax rates of competing municipalities.

Testing Hypothesis 3 involves three steps in the spatial analysis: 1) Moran *I* tests (Moran, 1950) on municipal property tax rates (MTR_{it}), 2) Lagrange-Multiplier (LM) and robust LM tests on OLS residuals of the non-spatial tax rate setting model (Equation 1), and 3) a significance test on the coefficient of the spatially lagged dependent variable ($\boldsymbol{W}MTR_{it}$) in the spatial lag tax rate setting model (Equation 2). In the first step, if the Moran *I* test on municipal property tax rates shows no spatial autocorrelation, Hypothesis 3 is rejected. In the second step, if the LM and robust LM tests on the OLS residuals of the non-spatial municipal tax rate model suggest that the spatial error model is the correct model, then Hypothesis 3 is also rejected.

In the final step, Hypothesis 3 is tested by examining the statistical significance of the coefficient on the spatially lagged dependent variable. Since the theory of inter-jurisdictional competition shows that the slope of the reaction function can be either positive or negative (Brueckner and Saavedra, 2001), the proper test for the presence of inter-jurisdictional competition is a statistical significance test on the estimated spatial slope coefficient (β_3). Consequently, only if the Moran *I* tests on the dependent variable and LM and robust LM tests on the OLS residuals of the non-spatial model support the presence of spatial dependence in the dependent variable and the spatial slope coefficient of the spatial lag model is statistically significant, we can provide the evidence supporting the presence of inter-jurisdictional property tax competition.

C. Estimation Strategy and Econometric Issues

a. Estimation strategy

Before proceeding to the spatial regression analysis, this study examines if there is a discernable spatial autocorrelation in municipal property tax rates (MTR_{it}) and thus a spatial framework is required to analyze the property tax rate setting. For this purpose, we examine spatial dependence in municipal property tax rates using a quantile map. Then, we perform a formal spatial autocorrelation test on the municipal property tax rates by the Moran *I* statistic which calculates a linear association between the tax rate of a given municipality and a weighted average of its competitors. Corresponding to the four different public markets defined in the previous section, four different spatial weight matrixes are used to compute the Moran *I* statistics.

Based on the results of the Moran *I* tests on the municipal property tax rates, we decide whether or not to proceed to the spatial analysis. If the results show that there is no spatial autocorrelation in municipal property tax rates, we reject Hypothesis 3 that there is competition among municipalities in setting property tax rates. As a result, we stick to the non-spatial regression analysis, which examines only intra-jurisdictional competition in setting property tax rates. On the other hand, if we find a statistically significant spatial autocorrelation in municipal property tax rates, we precede to the next step of the spatial analysis.

To find out whether a spatial lag model or a spatial error model is more relevant to analyze the property tax rate setting, we perform a spatial autocorrelation test on the OLS residuals of the non-spatial tax rate setting model. Since the Moran *I* test is unable to tell which of the two spatial models is the appropriate model (Brueckner, 1998), we use LM and robust LM tests developed by Anselin et al. (1996) for spatial lag dependence and spatial error dependence in the OLS residuals. In identifying the proper spatial regression specification, we follow Anselin's (2005) "spatial regression model selection decision rule" (pp.198-200). The selected spatial lag or spatial error model is estimated either by an Instruments Variable (IV) or by a Maximum Likelihood (ML).

b. Econometric issues and solutions

As discussed above, competing municipalities' tax rates ($\boldsymbol{W}MTR_{it}$) affect a given municipality's tax rates (MTR_{it}). At the same time, these competing municipalities' tax rates are influenced by the given municipality's tax rates. If this underlying feature of the model is correct, competing municipalities' tax rates are endogenous. In addition, school district tax rates (STR_{it}) and county tax rates (CTR_{it}) are also suspected to be endogenous. It may not be realistic to assume that the county reacts to each of the municipalities' tax rates when setting property tax rates. However, even if the county tax rates were exogenous, some correlation could remain between this variable and the error term, due to the existence of common shocks to both tax rates. To solve the endogeneity issues associated with the three mentioned variables, we estimate tax rate setting equations using either IV or ML estimation.

Since school district tax rates and county tax rates are suspected to be endogenous, we obtain OLS residuals for LM tests by estimating the non-spatial tax rate setting model

(Equation 1) by a two-step IV approach. In the first stage, the county property tax rate and school district property tax rates are regressed on exogenous explanatory variables (X_{it-k}) of Equation (1) and instrument variables. In the second stage, the fitted values of county property tax rates (CTR_{it}_HAT) and school district property tax rates (STR_{it}_HAT) are used in estimating the Equation (1) by OLS to obtain residuals used to test spatial dependence by LM tests.

We also use a two-step IV approach to estimate the spatial lag model (Equation 2). For this purpose, we first create spatially lagged exogenous explanatory variables ($\boldsymbol{W}X_{it-k}$) and the spatially lagged dependent variable ($\boldsymbol{W}MTR_{it}$) by using GeoDa™. In the second stage, the spatially lagged explanatory variables, and county and school district demographic variables are used as instruments for the endogenous spatially lagged dependent variable, school district tax rates, and county tax rates. This two step IV approach is performed by Stata's IV generalized moments method (GMM) estimation developed by Baum, Schaffer, and Stillman (2007).

On the other hand, for estimating the spatial error tax rate setting model (Equation 3), we regress school district tax rates, and county tax rates on county demographic variables, school district demographic variables, and all exogenous explanatory variables of the non-spatial tax rate setting model (Equation 1). Then, the fitted values of county property tax rates and school district property tax rates are used to estimate the spatial error tax rate setting model (Equation 3) by using Kelejian and Prucha's (1999) GMM in the spdep package in R.

4-3-2. Effect of Competition on Property Tax Rates

We develop a combined property tax rate model to examine the effect of inter-jurisdictional competition (Hypothesis 4), market share (Hypothesis 7), school district consolidation (Hypothesis 8), and intra-jurisdictional competition (Hypothesis 11). All theories of inter-jurisdictional competition have a common prediction that competition leads to lower tax rates. On the other hand, intra-jurisdictional competition theory posits that the combined tax rate of two overlapping government is higher than a coordinated or unitary government's tax rate. However, these theoretical predictions have not been empirically examined, while empirical studies have exclusively focused on the effect of competition on government size or on public sector size.

A. Combined Municipal-School District Tax Rate Model

In New Jersey, the relationship between a municipality and a Type I school district can be regarded as a coordinated case compared to that between a municipality and a Type II school district. The variation in the relationship between the municipal government and the school district gives us a unique opportunity to investigate the effect of intra-jurisdictional competition. To test the effect of inter- and intra-jurisdictional competition simultaneously, we, therefore, use the combined tax rate of the municipality and the school district as the dependent variable.

The combined municipal-school district tax rate model can be specified as follows:

$$MSTR_{it} = \beta_0 + \beta_4 COM_{it} + \beta_5 MS_{it} + \beta_6 CONSOL_i + \beta_7 INTRA_{it} + X_{it-k}\theta + T_t\delta + \varepsilon_{it}, \quad (4)$$

where the subscripts *i, t,* and *k* represent the municipality (i = 1, …, 566), year (t = 2001, …, 2004), and a time lag (k = 0, or 1), respectively. $MSTR_{it}$ represents the sum of municipal and school district property tax rates, COM_{it} denotes the degree of inter-jurisdictional competition, MS_{it} is market share, $CONSOL_i$ is a dummy variable for a community which is a member of a consolidated school district, $INTRA_{it}$ is a dummy variable for a community with a Type II school district, X_{it-1} is a matrix of exogenous control variables, T_t is a group of dummy variables for years with an exception of 2001, and ε_{it} is well behaved error term.

a. Measures for the degree of inter-jurisdictional competition

One of the most important independent variables is the degree of inter-jurisdictional competition. Following the previous empirical literature, this study uses two kinds of measures for inter-jurisdictional competition: the number of municipal governments in a public market (COM_{it}) and a measure of public market share (MS_{it}). These two measures for the degree of inter-jurisdictional competition are also included as independent variables in a hedonic property value model and a technical efficiency model which are specified in the following two sub-sections.

Two alternative measures of inter-jurisdictional competition have been used in examining the effect of competition on government performance: the number of competing governments and the market share. Most empirical studies employ the number of governmental units in a public market (Oates, 1985; Nelson, 1987; Zax, 1989; Stansel, 2006). Some employ a market-share measure analogous to concentration ratios used in the private sector (Eberts and Gronberg, 1990). Others measure the inter-jurisdictional competition using both kinds of measures. Either one alone cannot capture inter-jurisdictional competition.

We measure the degree of inter-jurisdictional competition as the total number of municipalities per 1000 persons in a public market, which is defined in the previous section based on contiguity, distance, and the county boundary. To account for widely varying sizes of public markets, the number of municipalities is divided by the population of the public market. Since the number of local governments provides a measure of alternative suppliers of local public services in a given public market, a greater number of municipalities implies more intensive inter-jurisdictional competition.

Under this measurement of inter-jurisdictional competition, it is, however, impossible to discriminate competition among municipalities from competition among school districts. This is because, in New Jersey, jurisdictions of municipalities and school districts are identical with the exception of 70 communities which are members of consolidated school districts. As a result, the measure for the degree of inter-municipal competition is almost identical to the measure for the intensity of inter-school district competition. Nevertheless, the total number of municipalities and school districts in a public market is not appropriate since a municipal government in one jurisdiction does not compete with school districts in other jurisdictions and vice versa.

The second measure of inter-jurisdictional competition is a public market share, analogous to concentration ratios used in the private sector. To measure the degree of inter-jurisdictional competition, some studies borrow the Herfindhal-Hirshman index (HHI) or the four-firm concentration ratio from the private sector. This kind of inter-jurisdictional competition measure reflects the distribution of market share between participants in a public market. However, due to the difficulty in implementing the HHI or the four-firm concentration ratio, this study measures the public market structure by a simple market share, which is calculated as $MS_{it} = P_{im}/P_m$, where P_{im} is the population of municipality i in public market m, and P_m is the respective public market's population.

When the public market is defined based on contiguity and distance criteria, it is very difficult to calculate the HHI because the public market varies by each jurisdiction. No spatial econometric software provides a function to calculate such an index and calculating the index manually is a very demanding job when the number of observations is substantially large. In addition, when the public market is defined by contiguity and geographic distance criteria, a concentration index, such as the four-firm concentration ratio, cannot be used because some jurisdictions have fewer than four neighbors or competitors.

The number of governmental units in a public market is a more direct measure for inter-jurisdictional competition and better reflects theories of inter-jurisdictional competition than the market concentration measure. Tiebout, the tax competition theory, and the Leviathan hypothesis are based on the mobility of residents among competing governmental units. The yardstick competition theory is based on information of competing jurisdictions being used as a yardstick for evaluating government performance. Therefore, unlike in the private sector, measures for market concentration may not be appropriate measures for the degree of competition in the public market and the number of alternative or competing governmental units is more important than the public market structure.

b. Control variables

The matrix X_{it-1} includes factors which are assumed to have impacts on the combined municipal-school district tax rates. Due to the possible endogeneity problem or the lack of recent data, some control variables are lagged one year and others are lagged four years, with the exception of political institutional variables which are almost time-constant. The shorthand name, the definition, and the empirical measure of the control variables are as follows:

CTR_{it} : Effective county property tax rate = Total property tax levy for county purposes ($) $\div$ Equalized valuation ($) $\times$ 100;

Ln_PMTL_{it-1} : Log of municipal property tax levy per capita = Log [Total property tax levy for municipal purposes ($1,000) $\div$ Estimated population] ;

Ln_PSTL_{it-1} : Log of school district property tax levy per capita = Log [Total property tax levy for school purposes ($1,000) $\div$ Estimated population];

$PMSA_{it-1}$: State aid to municipality per capita = Total state aid to municipality ($1,000) $\div$ Estimated population;

$PSSA_{it-1}$: State aid to school district per capita = Total state aid to school district ($1,000) $\div$ Estimated population;

POP_{it-1} : Municipal population = Estimated population as of July 1 (1,000 persons);

$POPD_{it-1}$: Municipality population density = Estimated population (1,000 persons) $\div$ Land area (square mile);

INC_{it-1} : Personal income = Total personal income ($1,000) $\div$ Number of taxpayer plus dependents;

Ln_POV_{it-1} : Log of poverty rate = Log [Number of children aged 5-17 receiving TANF $\div$ Estimated population (1,000 persons)];

RBP_{it-1} : Residential building permits = Total number of new residential units authorized for construction;

UER_{it-1} : Unemployment rate = Estimated number of unemployment $\div$ Estimated number of labor force $\times$ 100;

PSD_{it-1} : Percent of enrolled pupils resident = Total number of enrolled pupils resident $\div$ Estimated population $\times$ 100;

$P65_i$: Percent of population aged 65 or over in 2000 = Number of population aged 65 or over $\div$ 2000 census population $\times$ 100;

PBA_i : Percent of population with BA or higher in 2000 = Number of population over age 25 with a bachelor's degree or higher $\div$ 2000 census population $\times$ 100;

PAA_i : Percent of African-American population in 2000 = Number of African-American $\div$ 2000 census population $\times$ 100;

PHO_i : Percent of home ownership in 2000 = Total number of owner-occupied units $\div$ Total number of occupied units $\times$ 100;

CRI_i : Crime rate = Total number of offenses reported in 2000 $\div$ 2000 census population $\times$ 1,000;

DD_{it} : Direct democracy institution = Dummy (1 if a municipality has initiative and/or referendum and 0 otherwise);

$FMG1_{it}$: Elected governing body and chief executive form of municipal government = Dummy (1 if both governing body and chief executive are elected by voters and 0 otherwise); and

$FMG2_{it}$: Elected governing body-administrator form of municipal government = Dummy (1 if a municipality operates under township, village, or commission form and 0 otherwise).

We add the percentage of enrolled resident pupils (PSD_{it-1}), state aid to school district per capita ($PSSA_{it-1}$), the log of school district property tax levy per capita (Ln_PSTL_{it-1}), and dummy variables for years (T_t) to the control variables of the spatial tax rate setting model (Equation 2). In addition, county property tax rates (CTR_{it}) is included as a control variable.

The tax rate depends on the level of revenues needed to finance public services. As in the spatial tax rate model (Equation 2), the property tax levy for education (Ln_PSTL_{it-1}) is included to control for the amount of money, which is used to finance education services, to be raised through the property tax. The tax levy for education is expected to have a positive effect on the combined municipal-school district since a higher tax rate is needed to support greater expenditures for education.

Aside from the property tax, school districts rely heavily on state aid to finance public education (see Table 3-12). As the literature on intergovernmental transfers suggests, state aid is expected to induce school districts to reduce property taxes. However, it is also possible that state aid has a positive effect on the tax rate. In New Jersey, the state's foundation aid formula gives more state aid to school districts (with a lower property tax base. Consequently, the effect of state aid to school districts on the combined tax rate can be either positive or negative.

The percentage of enrolled resident pupils (PSD_{it-1}) is included as a proxy for both the demand for public services and the fiscal capacity of a community. On the one hand, a larger percentage of resident students may represent a higher demand for public services, especially public education and, thus, lead to higher tax rates to finance the higher public services. On the other hand, the greater percentage of resident students may reflect the weak fiscal capacity of a community and, thus, result in higher tax rates. Consequently, the percentage of enrolled resident pupils is expected to have a positive effect on the combined municipal-school district tax rate.

We include the county property tax rate (CTR_{it}) to control for the interdependence in the tax rate setting between county government and other types of local governments within its jurisdictional boundary. As the intra-jurisdictional competition theory predicts, county tax rates can have either a positive or a negative effect on the combined municipal-school district tax rate. We also include year dummy variables (T_t) to control for shocks that are common to all communities but change across the time periods.

B. Hypothesis Test

a. Inter-jurisdictional competition

All theories of inter-jurisdictional competition agree that the degree of inter-jurisdictional competition is inversely related to tax rates (Hypothesis 4). Although the measure for the degree of inter-jurisdictional competition (COM_{it}) reflects inter-municipal and inter-school district competition, both inter-municipal and inter-school district competition are expected to reduce municipal and school district tax rates, respectively. Therefore, the degree of inter-jurisdictional competition is expected to have a negative impact on the combined municipal-school district tax rate ($MSTR_{it}$). The negative and statistically significant coefficient on the degree of inter-jurisdictional competition (β_4) confirms Hypothesis 4.

b. Market share

Regarding the relative size of competing jurisdictions, Bucovetsky (1991) and Wilson (1991) posit that small jurisdictions in terms of population may have competitive advantages and that they set their tax rates lower than those of their larger competitors. Based on the asymmetric tax competition theory, we hypothesized that communities' relative population shares of the total population of a public market are positively related to the property tax rate (Hypothesis 7). This hypothesis is tested by examining the effect of the market share (MS_{it}) on the combined municipal-school district tax rate. The positive and statistically significant coefficient on the market share (β_5) support Hypothesis 7.

c. Local government consolidation

We predict that there is a difference in tax rates between communities which are members of a consolidated school district and communities with the regular school district (Hypothesis 8). The effect of school district consolidation is captured by the dummy variable for communities which are members of a consolidated school district ($CONSOL_i$). This dummy variable reflects the average difference in tax rates between communities with a regular school district and communities which are members of a consolidated school district. The test of Hypothesis 8 is a simple significance test of the coefficient (β_6) associated with the dummy variable $CONSOL_i$ because the sign is theoretically ambiguous. However, we can investigate which theoretical perspective is correct by examining the sign of the coefficient (β_6).

d. Intra-jurisdictional competition vs. budget referendum

The effect of intra-jurisdictional competition (Hypothesis 11) is tested by examining the sign of the coefficient of the dummy variable for communities with a Type II school district ($INTRA_{it}$). As stated in the hypotheses section, however, the dummy variable reflects two contrasting effects, the intra-jurisdictional competition effect and the budget referendum effect. The coefficient of this dummy variable (β_7), therefore, could have either a positive or a negative effect on the combined tax rate. The positive coefficient indicates the dominance of the budget referendum effect and the negative effect means that the intra-jurisdictional competition effect outweighs the referendum effect.

C. Econometric Issues and Solutions

Among the control variables, the county tax rate (CTR_{it}) is suspected to be endogenous because of the reciprocal effect among municipalities, school districts, and counties in setting tax rates. It my be more realistic to believe that a county government does not respond to changes in the tax rates of municipalities and school districts within its boundary due mainly to its larger size. However, some correlation may still remain between the county tax rate and the error term even though the county tax rate is exogenous. This is because some economic conditions have an impact on county, school district, and municipal tax rates. Therefore, the estimated coefficient of the county tax rate may pick up some spurious correlation. We include a set of time dummies to control for shocks to all municipalities, school districts, and counties. This approach has been used in previous empirical investigations to solve the potential endogeneity (for example, Boadway and Hayashi, 2000; Esteller-Moré and Solé-Ollé, 2001).

4-3-3. Allocative Efficiency Model

The allocative efficiency model is developed to test the effect of inter-jurisdictional competition (Hypothesis 5) and the effect of school district consolidation (Hypothesis 9) on government allocative efficiency. There are two contrasting views on the consequences of inter-jurisdictional competition and local government consolidation in terms of government allocative efficiency. We can tell which theoretical perspective is correct by testing the above two hypotheses.

A. Brueckner's Property Value Maximization Thesis

Building on the conclusion that property value-maximizing behavior by local officials can lead to a Pareto-efficient provision of local public goods (Brueckner, 1979), Brueckner (1979, 1982) developed a theoretical model of property value determination which can be used to test for allocative efficiency in local governments. In his model, aggregate property value in a community which levies a property tax is an inverted U-shaped function of its public good outputs, with the maximum occurring at the output level which satisfies the Samuelson condition for Pareto-efficiency. Brueckner (1979, 1982) demonstrated that if a marginal increase in public spending has no effect on aggregate property value in an open community, holding the housing stock fixed, then the Samuelson condition for allocative efficiency in the provision of public goods is satisfied.

Brueckner (1979, 1982) empirically demonstrated that hedonic estimates of property values can be used to test for allocative efficiency in local governments. By estimating a hedonic regression model where the dependent variable is total property value and the public good expenditure level is included as an independent variable, the location of the data points on the hyper surface can be determined (Deller and Chicoine, 1993). A positive coefficient on expenditure would be interpreted as evidence against systematic overprovision, while a negative coefficient means that the public good is not being systematically underprovided. The same line of reasoning suggests that a zero coefficient is evidence against both systematic underprovision and overprovision (Brueckner, 1982; Brueckner and Wingler 1984).

Brueckner's (1979, 1982) intriguing proposition has spawned numerous empirical studies that test for allocative efficiency in government decision making. A cross-sectional regression model relating property values to public expenditures and other determinants of property values forms the basis for the efficiency test. Deller (1990), Shah (1992), Deller and Chicoine (1993), and Taylor (1995), among others, use Brueckner's (1979, 1982) approach to test for allocative efficiency in the provision of local public goods. Grossman, Mavros, and Wassmer (1999), Hughes and Edwards (2000), and Bates and Santerre (2006) use Brueckner's (1979, 1982) approach to examine the effect of competition on allocative efficiency.

B. Hedonic Property Value Model

To investigate the effect of inter-jurisdictional competition, local government consolidation, and local public market share, this study develops a property value model based on the Brueckner's (1979, 1982) theoretical model and empirical studies employing his model. Because most empirical studies, such as, Deller (1990), Taylor (1995), and Bates and Santerre (2006), employ a log-log specification, this study specifies the hedonic property value regression model in a log-linear functional form. The log-linear hedonic property value model is as follows:

$$Ln\_TPV_{it} = \beta_0 + \beta_8 Ln\_COM_{it} + \beta_9 CONSOL_{it} + \beta_{10} INTRA_{it} + X_{it-k}\theta + \varepsilon_{it}\,, \qquad (5)$$

where subscripts *i, t,* and *k* denote the municipality (i = 1, …, 566), year (t = 2004), and a time lag (k = 0, 1, or 4), respectively. *Ln_* represents the natural logarithm, [39] TPV_{it} denotes total property values, COM_{it} represents the degree of inter-jurisdictional competition, $CONSOL_{it}$ is a dummy variable for communities which are members of a consolidated school district, X_{it-k} refers to a matrix of exogenous control variables, and ε_{it} is a well behaved error term.

a. Total property value

The dependent variable, total property value ($1,000), is measured by the total equalized value of property subject to local property taxation for 2004. The total equalized property value is calculated as follows:

$$\text{Total Equalized Property Value} = \frac{\text{Total Taxable Value of Land and Improvements}}{\text{State Equalization Ratio}} \div \$1000$$

The land and improvements include vacant land, farm land, residential property, farm homestead property, commercial property, industrial property, and apartments. Machinery implements and telephone messenger system equipment are also subjected to the property tax but are excluded from the total taxable property value. Data on the total taxable value of land and improvements and the state equalization ratio come from the Tax Table and the Abstract of Ratables provided by NJ DLGS, respectively.

b. Control variables

Based on Brueckner's (1979, 1982) theoretical model and subsequent empirical studies, the list of control variables for the hedonic property value model (Equation 5)

39. In some variables, the minimum value is zero. To take logarithms, we add to such values a unit of measurement associated with that variable so as to assure the minimum value is greater than zero.

includes determinants of property value, demand factors for local public goods, and political imitations. Expenditure variables are lagged one year since there is an inherent time delay in public expenditures being capitalized into the value of property. All other control variables are also lagged one or more years due to potential endogeneity and the lack of available recent data. The shorthand name, the definition, and the empirical measurement of control variables are as follows:

Ln_MS_{it} : Log of market share = Log [Population of a municipality $\div$ Total population of its respective public market];

Ln_TMB_{it-1} : Log of municipal budget = Log [Total expenditure on municipal purposes ($1,000)];

Ln_TSB_{it-1} : Log of school district budget = Log [Total expenditure on education ($1,000)];

Ln_MSSA_{it-1} : Log of state aid to the municipality and the school district = Log [Sum of state aid to the municipality and the school district ($1,000)];

Ln_HOS_{it} : Log of housing stocks = Log [Number of residential parcels];

LN_PCIV_{it} : Log of percent of commercial and industrial property value = Log [Sum of commercial and industrial property value ($1,000) $\div$ Total property value ($1,000) $\times$ 100];

Ln_MNR_{it-4} : Log of median number of rooms;

Ln_HB70_{it-4} : Log of percent of housing built before 1970 = Log [Number of housing units built before 1970 $\div$ Total housing units $\times$ 100];

$POPG_{it-1}$: Population growth rate = Estimated population in year t - Estimated population in year t-1 $\div$ Estimated population in year t-1 $\times$ 100;

Ln_POPD_{it-1} : Log of municipality population density = Log [Estimated population (1,000 persons) $\div$ Land area (square mile)];

Ln_INC_{it-1} : Log of personal income = Log [Total personal income ($1,000) $\div$ Number of taxpayer plus dependents];

Ln_POV_{it-1} : Log of poverty rate = Log [Number of children aged 5-17 receiving TANF $\div$ Estimated population (1,000 persons)];

Ln_RBP_{it-1} : Log of residential building permits = Log [Total number of new residential units authorized for construction];

Ln_UER_{it-1} : Log of unemployment rate = Log [Estimated number of unemployment $\div$ Estimated number of labor force $\times$ 100];

Ln_CRI_{it-4} : Log of crime rate = Log [Total number of offenses reported in 2000 $\div$ 2000 census population $\times$ 1,000];

DD_{it} : Direct democracy institution = Dummy (1 if a municipality has initiative and/or referendum and 0 otherwise);

$INTRA_{it}$	:	Intra-jurisdictional competition between municipalities and school districts = Dummy (1 if a school district is a Type I school district and 0 otherwise);
$FMG1_{it}$	:	Elected governing body and chief executive form of municipal government = Dummy (1 if both governing body and chief executive are elected by voters and 0 otherwise); and
$FMG2_{it}$	:	Elected governing body-administrator form of municipal government = Dummy (1 if a municipality operates under township, village, or commission form and 0 otherwise).

Two government expenditures are included in the hedonic regression model: total municipal expenditure (Ln_TMB_{it-1}) and total school district expenditure (Ln_TSB_{it-1}). These two variables are used to test whether or not local public goods are provided in an allocatively efficient manner by examining the significance and sign of their coefficients. The coefficients on these variables can be positive, negative, or zero (see Brueckner, 1979, 1982). State aid to municipality and school district (Ln_MSSA_{it-1}) is also deemed to be important because of the relatively large percentage of total local revenues coming from state sources (see Table 3-12). State aid is expected to have a positive effect on the property value.

The hedonic property value model does not include tax variables as explanatory variables. This is because the inclusion of tax variables as well as expenditure variables in the property value equation violates local government budget constraints (Deller, 1990, Shah, 1992). Therefore, the coefficient of local government expenditures shows how property values change if local government expenditures are increased and taxes are raised to cover the cost of that increase (Deller, 1990).

Several variables are used to capture the effect of housing stock characteristics on the total property values. The total number of residential parcels (LN_HOS_{it}) represents the absolute size of a community's housing stock and is expected to have a positive impact on the property value. The median number of rooms (Ln_MNR_{it-4}) and the percentage of houses built before 1970 (Ln_HB70_{it-4}) measure the quality of housing stock. The former is expected to have a positive effect and the latter is expected to have a negative impact on the property value. The percentage of commercial and industrial property values (LN_PCIV_{it}) is included to account for alternative land uses and there is no a priori expectation on the sign of its coefficient.

To control for the effect of socio-economic characteristics of a community on property values, the hedonic property value model includes population growth ($POPG_{it-1}$), population density (Ln_POPD_{it-1}), personal income (Ln_INC_{it-1}), poverty rate (Ln_POV_{it-1}), residential building permits (Ln_RBP_{it-1}), unemployment rate (Ln_UER_{it-1}), and crime rate (Ln_CRI_{it-4}). Population growth, population density, poverty rate, unemployment rate, and crime rate are undesirable conditions and thus are expected to have negative effects on property value. Personal income and residential building permits are expected to be positively related to property value.

To control for the possible effect of political institutions on property value, the hedonic model includes the direct democracy institution of municipality (DD_{it}), a dummy variable for a community with a Type II school district ($INTRA_{it}$), and dummy variables for the forms of municipal government ($FMG1_{it}$ and $FMG2_{it}$). Finally, the hedonic model also includes the public market share (Ln_MS_{it}) to control for the relative population size of a community to its respective public market's population. We have no prior expectation on the sign of coefficients on these variables.

C. Hypothesis Test

a. Inter-jurisdictional competition

In the previous section, we drew a hypothesis that inter-jurisdictional competition affects allocative efficiency without specifying the exact direction of the effect (Hypothesis 5). This is because various theories have contrasting views on the consequences of inter-jurisdictional competition in terms of allocative efficiency. While the tax competition literature suggests that inter-jurisdictional competition results in inefficient resource allocation, Tiebout, the Leviathan hypothesis, and the yardstick competition theory argue that it enhances allocative efficiency. The test of Hypothesis 5 is the simple significance test of the coefficient (β_8) on the degree of competition (COM_{it}).

By measuring the impact of the degree of inter-jurisdictional competition on property value, this study may provide evidence to help discriminate between two competing views on the effect of competition on government allocative efficiency: Tiebout, the Leviathan hypothesis, and yardstick competition vs. the conventional tax competition theory. A positive coefficient on the degree of inter-jurisdictional competition implies that a greater number of governmental units are superior from a property value perspective and thus confirms the beneficial views of inter-jurisdictional competition.

b. Local government consolidation

The effect of school district consolidation on allovative efficiency (Hypothesis 10) is tested by the coefficient (β_9) associated with the dummy variable for communities which are members of a consolidated school district ($CONSOL_{it}$). The dummy variable captures the average difference in property values between communities which are members of a consolidated school district and communities with regular school districts, other things being equal. The test of Hypothesis 10 is a simple significance test because we did not specify the sign of the effect the school district consolidation would have on allocative efficiency due to the two contrasting theoretical predictions. By examining the sign of coefficient, we may tell which theoretical prediction is correct between the two competing perspectives: Tiebout, the Leviathan hypothesis, and yardstick competition v.s. the conventional tax competition theory.

c. Intra-jurisdictional competition vs. budget referendum

The effect of difference in relationships between municipal government and school district (Hypothesis 12) is captured by the dummy variable for communities with the Type II school district ($INTRA_{it}$). This dummy variable reflects both the efficiency worsening effect of intra-jurisdictional competition and the efficiency enhancing effect of the school budget referendum. Hypothesis 12 is tested by examining the statistical significance and the sign of coefficient (β_{10}) on the $INTRA_{it}$. A positive coefficient implies the dominance of the budget referendum effect and a negative coefficient indicates the dominance of intra-jurisdictional competition.

4-3-4. Technical Efficiency Model

The technical efficiency model is constructed to test the effect of inter-jurisdictional competition (Hypothesis 6) and the effect of school district consolidation (Hypothesis 10) on government technical efficiency. To test Hypotheses 6 and 10, this study uses a two-step procedure. In the first stage, the Data Envelopment Analysis (DEA) efficiency model is used to measure technical efficiency scores for 566 New Jersey local governments from 2001 to 2004. In the second sage, a Tobit censored regression model is specified, taking into account the distributional characteristics of the technical efficiency scores.

A. DEA Efficiency Analysis

Technical efficiency refers to the ability of an organization to avoid waste by producing the maximum possible outputs from a given set of inputs or by achieving a given level of outputs with the minimum inputs (Dollery, Wallis, and Worthington, 2001). Various approaches have been applied to measuring technical efficiency. These techniques can be classified into two major subgroups: 1) parametric methods, such as Stochastic Frontier Analysis (SFA), Deterministic Frontier Analysis (DFA), and Corrected Ordinary Least Squares (COLS), and 2) non-parametric methods such as Total Factor Productivity (TFP), Free Disposal Hull (FDH), and the DEA (De Boger and Kerstens, 1996a; Dollery, Wallis, and Worthington, 2001).[40] For two reasons, this study uses the DEA approach to measure the technical efficiency of New Jersey local governments. First, the DEA approach allows for the decomposition of total technical efficiency into pure technical efficiency and scale efficiency. Second, the DEA does not require identifying a functional form or making distributional assumptions.

Based on Farrell's (1957) frontier analysis, DEA approach is developed by Charnes, Cooper, and Rhodes (1978) and Banker, Charnes, and Cooper (1984) among others (De Borger and Kerstens, 1996a). DEA is a non-parametric mathematical

40. See De Boger and Kerstens (1996a) and Dollery, Wallis, and Worthington (2001) for a good review of various techniques for measuring government efficiency and a good survey of empirical studies employing those techniques. See Charnes, Cooper, Lewin, and Seiford (1995) and Thanassoulis (2001) for a good description of the DEA.

programming technique to construct a best practice frontier over a set of organizations, which are called decision making units (DMUs) in the DEA literature. Then, efficiency measures for each DMU are calculated as distances from the frontier (Woodbury and Dollery, 2004). The DEA efficiency measure is called relative efficiency because it is measured by comparing a DMU's efficiency to some set of DMUs' efficiency.

a. DEA efficiency model

Measuring technical efficiencies using DEA requires data on output and input quantities of DMUs. DEA combines all the input and output information into a single measure of efficiency that lies between zero and unity. The identification of the input and output variables to be used in an assessment of relative or comparative efficiency is the first and the most important stage in carrying out a DEA analysis (Thanassoulis, 2001). To measure technical efficiency, this study uses one output indicator and seven input indicators for 566 communities from 2001 to 2004. Input and output variables required for the DEA analysis are described as follows:

TPV_{it} : Total property value = Total equalized value of land and improvements ($1,000);
TMB_{it-1} : Total expenditure on municipal purposes ($1,000);
TSB_{it-1} : Total expenditure on education ($1,000);
$PCTL_{it-1}$: Total property tax levy for county purposes ($1,000);
$MSSA_{it-1}$: Sum of state aid to the municipality and the school district ($1,000);
HOS_{it} : Housing stocks = Number of total residential parcels;
CI_{it} : Number of commercial and industrial parcels; and
LA_i : Land areas (square miles).

We choose equalized total property values (TPV_{it}) as the output indicator. As shown in Chapter III, local public services in New Jersey are closely related to property value. In addition, the capitalization literature has demonstrated that local government policies are capitalized into property values. It is highly likely that the property values capture important aspects of most public services provided by local governments. In addition, property is the base of the local property tax, which is the main revenue source for local governments in New Jersey. Therefore, the property values represent the ability of local governments to generate revenues. With a strong property tax base, a community can choose a high level of public services at moderate tax rates or a low level of services at even lower tax rates. Consequently, local governments want to maximize their property values. Based on Brueckner's (1979, 1982) and his followers' models and empirical studies employing DEA, determinants of property values and local government expenditures are used as input indicators. The expenditure variables are one year lagged, assuming that there is a time delay in expenditure being capitalized into property values.

b. Orientation system and returns to scale

In calculating technical efficiency scores using DEA, we must specify two characteristics of the DEA model: the orientation system and the returns to scale. The DEA efficiency measure is based on estimates of the degree to which a DMU could have secured more outputs for its input levels, or the degree to which it could have used fewer inputs for its output levels (Thanassoulis, 2001). Therefore, we need to decide whether the DMUs have more discretion over input or over output levels. According to Thanassoulis (2001), the output orientation efficiency is appropriate when outputs are controllable and the input orientation is appropriate when inputs are controllable. We select the input orientation system, assuming that local governments take the output, the property values, as exogenous and have substantial control over input variables, especially expenditures.

The DEA approach constructs the non-parametric frontier as the piecewise linear combination of all efficient DMUs in a sample (De Borger and Kerstens, 1996a). This DEA frontier can be estimated either under constant returns to scale (CRS) or under variable returns to scale (VRS). To construct the non-parametric frontier, while the CRS approach compares all DMUs in a sample regardless of their size, the VRS approach compares DMUs within a similar scale (Wetzel, 2006). Consequently, the CRS approach produces an overall technical efficiency score which is a combination of pure technical and scale efficiency and the VRS approach only calculates pure technical efficiency (Hughes and Edwards, 2000).[41] According to Worthington (2000), the CRS approach is only appropriate where all DMUs are operating at an optimal scale. This study follows the VRS approach, recognizing that local governments are not operating at an optimal scale and pure technical efficiency is appropriate to examine the arguments from theories of inter-jurisdictional competition.

B. Tobit Censored Regression Analysis

In the second stage, a technical efficiency regression model is developed to test Hypothesis 6 and Hypothesis 10. As a result of the DEA analysis in the first stage, pure technical efficiency scores for each community in each year are obtained. The technical efficiency scores are used as the dependent variable in the technical efficiency regression model. The selection of a regression model explaining differences in the technical

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41. The difference between the VRS efficiency score and the CRS efficiency score indicates the presence of scale efficiency. The scale efficiency score can be calculated from the difference between the VRS efficiency score and the CRS efficiency score.

efficiency scores among communities should consider the distributional characteristics of the efficiency scores. As the technical efficiency scores are bounded below by unity, a Tobit censored regression model is used.

a. Tobit censored regression model

The Tobit censored regression model is defined in terms of a latent variable (De Borger and Kerstens, 1996b). The latent technical efficiency (TE_{it}^{*}) is not directly observable. Instead, we can observe a technical efficiency score (TE_{it}) which is censored at the limit level of unity, thus partly masking the true value of TE_{it}^{*}. The TE_{it} is observed when TE_{it}^{*} is less than unity, while the TE_{it} equals unity when TE_{it}^{*} equals or is greater than unity. Therefore, the Tobit technical efficiency model can be specified as follows:

$$TE_{it}^{*} = \beta_0 + \beta_{11}COM_{it} + \beta_{12}CONSOL_i + X_{it-k}\theta + T_t\delta + \varepsilon_{it}, \tag{6}$$

$$TE_{it} = \begin{cases} TE_{it}^{*} & if\ TE_{it}^{*} < 1 \\ 1 & if\ TE_{it}^{*} \geq 1 \end{cases}$$

where the subscripts *i, t,* and *k* represent the community (i = 1, …, 566), year (t = 2001, …, 2004), and a time lag (k = 0 or 1), respectively. TE_{it} is the DEA technical efficiency score, COM_{it} is the degree of inter-jurisdictional competition, $CONSOL_{it}$ is a dummy variable for a community which is a member of a consolidated school district, X_{it-1} is a matrix of exogenous control variables, T_t is a group of dummy variables for each year with an exception of 2001, and ε_{it} is a error term.

b. Independent variables and hypothesis test

The degree of inter-jurisdictional competition (COM_{it}) and the dummy variable for communities which are members of a consolidated school district ($CONSOL_{it}$) are two independent variables. Hypothesis 6 and Hypothesis 10 are tested by examining the significance and the sign of β_{11} and β_{12}, respectively. Hypothesis 6 reflects the theoretical prediction of the Leviathan hypothesis and the yardstick competition theory that inter-jurisdictional competition enhances government technical efficiency by reducing government waste or government rent-seeking behavior. Thus, it is expected that the coefficient on COM_{it} (β_{11}) is positive.

There are two contrasting perspectives on the effect of local government consolidation on technical efficiency. In the view of the Leviathan hypothesis and the yardstick competition theory, consolidation of local governments reduces the degree of competition and, thus, leads to technical inefficiency. On the other hand, Oates (1972) and others argue that the merger of small units is associated with lower costs and greater technical efficiency due to scale economies. However, if the scale economies do not exist in the provision of local public services, consolidation may lead to technical inefficiency. It is difficult to predict the consequences of consolidation. By examining the significance and the sign of coefficient on $CONSOL_{it}$ (β_{12}), we evaluate which theoretical perspective is correct.

c. Control variables

The matrix of control variables (X_{it-1}) includes exogenous factors that may affect the technical efficiency of local governments. While a large number of studies have analyzed technical efficiency of local governments (De Borger and Kerstens, 1996b), factors affecting the local government technical efficiency are relatively under-examined. Empirical studies on the determinants of technical efficiency have found that political institutions, community characteristics, and the financial structure are related to the variation in local government technical efficiency (Dollery, Wallis, and Worthington, 2001). Based on the findings in these previous empirical studies, we select the following control variables: [42]

MS_{it}	: Market share = Population of a municipality $\div$ Total population of its respective public market;
$RMSA_{it}$	: Percent of state aid in municipal budget = Total state formula aid to municipality (\$1,000) $\div$ Municipal budget (\$1,000) $\times$ 100;
$RSSA_{it}$	: Percent of state aid in school district budget = Total state aid to school district (\$1,000) $\div$ School District budget (\$1,000) $\times$ 100;
POP_{it}	: Municipal population = Estimated population as of July 1 (1,000 persons);
$POPS_{it}$	: Square of estimated population;
$POPD_{it}$	: Municipality population density = Estimated population (1,000 persons) $\div$ Land area (square mile);
INC_{it-1}	: Personal income = Total personal income (\$1,000) $\div$ Number of taxpayer plus dependents;
Ln_POV_{it}	: Log of poverty rate = Log [Number of children aged 5-17 receiving TANF $\div$ Estimated population (1,000 persons)];
PSD_{it}	: Percent of enrolled pupils resident = Total number of enrolled pupils resident $\div$ Estimated population $\times$ 100;
PBA_{i}	: Percent of population with BA or higher in 2000 = Number of population over age 25 with a bachelor's degree or higher $\div$ 2000 census population $\times$ 100;
$P65_{i}$	: Percent of population aged 65 or over in 2000 = Number of population aged 65 or over $\div$ Population $\times$ 100;
DD_{it}	: Direct democracy institution = Dummy (1 if a municipality has initiative and/or referendum and 0 otherwise);
$INTRA_{it}$	: Intra-jurisdictional competition between municipalities and school districts = Dummy (1 if a school district is a Type II school district and 0 otherwise);
$FMG1_{it}$	: Elected governing body and chief executive form of municipal government = Dummy (1 if both governing body and chief executive are elected by voters and 0 otherwise); and
$FMG2_{it}$	: Elected governing body-administrator form of municipal government = Dummy (1 if a municipality operates under township, village, or commission form and 0 otherwise).

42. In the Tobit regression model, we do not include the variables used in calculating efficiency scores in the first stage DEA analysis because there may be an element of a double-count.

To capture the potential scale economies in providing local public services, population (POP_{it}) and population density ($POPD_{it}$) are included as exploratory variables. If scale economies are present, it is expected that population and population density are positively related to technical efficiency. A squared population ($POPS_{it}$) is included to account for the deceasing effect of scale economies and thus expected to have a negative effect on the technical efficiency score.

The share of population aged over 65 ($P65_i$), the number of children receiving TANF (Ln_POV_{it}), and the share of enrolled resident students (PSD_{it}) are included as a proxy for the demand for public services. These population groups tend to be heavy users of local public services. On the other hand, these population structure variables may also reflect the fiscal capacity of communities. High shares of these population groups represent the weak fiscal capacity of communities. Whether the share of these population groups is positively or negatively related to technical efficiency is not clear.[43]

It is well documented that the income and wealth of residents affect the incentives of both politicians and taxpayers (De Borger and Kerstens, 1996a, 1996b). Personal income (INC_{it-1}) is included in the technical efficiency model to control for this effect. A high level of personal income represents a strong fiscal capacity of communities and may foster government waste or rent-seeking behaviors (Silkman and Young, 1982). On the other hand, due to the high opportunity costs of time, the rich may be less motivated to monitor government performance (De Borger and Kerstens, 1996a, 1996b). Therefore, personal income (INC_{it-1}) is expected to have a negative impact on technical efficiency.

43. Because the most recent available data on personal income is 2003, a one year lagged variable is used.

The education level of residents may also affect the technical efficiency of local governments. Educated people may be more effective in demanding an efficient operation of local governments and in monitoring inefficient government behavior. In addition, the education level may also reflect the effect of a citizen's political participation, which is expected to enhance government performance. There is some evidence that political participation is associated with education level (Mueller, 2003). Thus, a high level of education increases the pressure on local governments to operate in a more efficient way (De Borger et al., 1994). The share of the population with a BA or higher (PBA_i) is expected to be positively associated with technical efficiency.

The technical efficiency of local governments may be affected by the institutional structure of local governments. To control for the effect of these political institutions, we include a dummy variable for a municipality with direct democracy institutions (DD_{it}), a dummy variable for a community with a Type II school district ($INTRA_{it}$), and dummy variables for the forms of municipal governments ($FMG1_{it}$ and $FMG2_{it}$). These variables capture the systematic differences in technical efficiency between different institutional structures of local governments. We have no prior expectation on the sign of the influence these political institution variables have on government technical efficiency.

We include the share of state aid in the municipal budget ($RMSA_{it}$) and in the school district budget ($RSSA_{it}$) to capture the effect of a revenue raising system on technical efficiency because the total amount of state aid to municipalities and school districts is used an input in the DEA model. The high share of outside funding may encourage or stimulate inefficient behavior of government officials because the cost of inefficient behavior is increasingly shared by a broader constituency (Silkman and Young, 1982; De Borger and Kerstens, 1996a, 1996b). It is expected that both the share of state aid in the municipal budget and in the school district budget is negatively related to technical efficiency.

In addition to the above control variables, the technical efficiency model incorporates market share (MS_{it}) and time dummy variables. The market share is included to control for the relative size of each community in the public market. The time dummy variables are included to control for shocks that are common to all communities but change from year to year. These shocks may reflect changes in the macro environment under which local governments operate. We have no prior expectation about the direction of the effect which the market share and the time dummy variables have on local government technical efficiency.

4-4. Source of Data and Descriptive Statistics

This section provides information on the source of each actual variable used in the regression analysis, on any modification of the original data, and descriptive statistics for each variable. Since the variables are drawn from 566 communities in New Jersey across several different years and cross-sectional regression analyses use data for the year 2004, descriptive statistics are provided for all communities for the year 2004 and for all communities in all the pooled years. The variables described by these statistics are used in the multiple regression analyses discussed in the next section. Table 4-2 presents the shorthand name used to identify each variable, its descriptive statistics, and the source of data.

The main sources of data are New Jersey state government*, New Jersey Legislative District Data Book* (LDDB), and the U.S. census. The data on property tax rates, property tax levy, property values, and state aid to municipal governments are based on Property Tax Tables, Abstract of Ratables, and Property Value Classification provided by the Division of Local Government Services (NJ DLGS) in the Department of Community Affairs (NJ DCA). Data on state aid to school districts are gathered from the Department of Education (NJ DOE). The data on population, land area, population density, the unemployment rate, and county personal income are taken from the Department of Labor and Workforce Development (NJ DLWD). The map of New Jersey municipal boundaries and crime rates are gathered from the Department of Transportation (NJ DOT).

The institutional structure of local governments such as the form of municipal government, direct democracy institutions of municipalities, and the Type of school districts are taken from the LDDB. Some municipal demographic data such as personal income and poverty rates are also based on the LDDB. Housing characteristics such as the median number of rooms and the percent of housing built before 1970 come from the U.S. census of 2000. The percentage of population age over 65, the percentage of adults with a BA or higher, and the percentage of African-Americans are also gathered from the U.S. census of 2000. Measures for the degree of inter-jurisdictional competition are calculated using population data and municipal boundary information.

Table 4-2. Descriptive Statistics and Data Source

Variable	Year 2004 (N=566)				Year 2001-04 (N=2264)				Source of Data [1]
	Mean	SD	Min	Max	Mean	SD	Min	Max	
Property Tax Rates									
MTR_{it}	0.514	0.427	0.000	5.666	0.555	0.444	0.000	5.838	DLGS
STR_{it}	1.205	0.547	0.000	8.396	1.285	0.507	0.000	8.396	DLGS
STR_{it-1}	1.273	0.507	0.000	7.740	1.329	0.486	0.000	7.740	DLGS
CTR_{it}	0.427	0.195	0.174	1.032	0.469	0.204	0.163	1.150	DLGS
$MSTR_{it}$	1.719	0.802	0.000	14.062	1.840	0.765	0.000	14.062	DLGS
Property Tax Levy									
$PMTL_{it-1}$	0.819	5.469	0.000	129.612	0.793	5.901	0.000	149.519	DLGS
$PSTL_{it-1}$	1.309	0.938	0.000	17.351	1.171	0.742	0.000	17.351	DLGS
$PCTL_{it-1}$	0.631	1.537	0.024	27.882	0.571	1.455	0.024	31.867	DLGS
Property Value									
TPV_{it}	1,658,953	1,940,553	2,443	12,800,000	1,382,340	1,634,957	0.0	12,800,000	DLGS
$PCIV_{it}$	17.7	13.6	0.0	98.6	18.0	13.5	0.0	98.6	DLGS
HOS_{it}	4,254.0	4,967.5	0.0	3,7482.0	4,197.0	4,909.7	0.0	37,482.0	DLGS
CI_{it}	247.5	444.4	0.0	6,853.0	247.3	433.4	0.0	6,932.0	DLGS
MNR_{i}	6.1	1.0	3.5	8.5	6.1	1.0	3.5	8.5	Census 2000
$HB70_{i}$	64.0	20.5	6.2	100.0	64.0	20.5	6.2	100.0	Census 2000
LA_{i}	13.1	18.2	0.1	111.3	13.1	18.2	0.1	111.3	DLWD
Budget and State Aid									
TMB_{it-1}	15,906.7	32,935.2	55.9	553,743.9	15,049.2	30,981.8	42.2	553,743.9	DLGS
TSB_{it-1}	16,859.6	19,786.8	0.0	136,229.5	15,151.6	17,963.3	0.0	136,229.5	DLGS
$PMSA_{it-1}$	0.197	0.578	0.061	13.007	0.195	0.571	0.061	13.007	DLGS
$PSSA_{it-1}$	0.463	0.446	0.000	2.544	0.453	0.435	0.000	2.568	DOE
$MSSA_{it-1}$	12,702.5	39,579.5	2.6	57,0277.1	12,310.7	38,212.7	2.6	570,277.1	Calculated
$RMSA_{it}$	13.6	6.2	0.8	42.7	14.4	6.7	0.7	47.8	Calculated
$RSSA_{it}$	26.7	23.3	0.0	100.0	27.8	23.4	0.0	100.0	Calculated
Demographics									
POP_{it}	15.267	23.102	0.018	277.770	15.150	23.018	0.018	277.770	DLWD
POP_{it-1}	15.203	23.073	0.018	276.956	15.058	22.944	0.018	276.956	DLWD
$POPS_{it}$	765.829	4,309.484	0.000	77,156.160	759.127	4,289.975	0.000	77,156.160	Calculated
$POPS_{it-1}$	762.579	4,301.991	0.000	76,704.630	752.912	4,270.242	0.000	76,704.630	Calculated
$POPD_{it}$	3.390	5.099	0.002	56.940	3.386	5.125	0.002	57.499	DLWD
$POPD_{it-1}$	3.389	5.119	0.002	57.204	3.380	5.127	0.002	57.499	DLWD
$POPG_{it-1}$	0.6	1.6	-1.2	17.6	0.7	2.4	-51.6	19.1	Calculated
$POPC_{it-1}$	477.529	253.615	64.433	893.756	472.696	252.678	64.143	893.756	DLWD
$INCC_{it-1}$	40.660	9.002	26.077	56.684	40.084	9.450	23.365	57.241	DLWD
PSD_{it}	15.6	4.6	0.000	61.1	15.6	4.6	0.000	83.3	LDDB
PSD_{it-1}	15.6	5.0	0.000	83.3	15.5	4.5	0.000	83.3	LDDB

(Continued)

Table 4-2. (Continued)

Variable	Year 2004 (N=566)				Year 2001-04 (N=2264)				Source of Data [1]
	Mean	SD	Min	Max	Mean	SD	Min	Max	
Demographics (Continued)									
INC_{it-1}	33.884	21.216	8.832	203.323	33.576	23.934	8.484	232.039	LDDB
POV_{it}	2.867	5.202	0.000	46.627	2.788	5.164	0.000	55.556	LDDB
POV_{it-1}	2.785	5.169	0.000	46.846	3.101	7.121	0.000	200.000	LDDB
RBP_{it-1}	58.3	127.5	0.0	1,652.0	55.8	116.5	0.0	1,652.0	LDDB
UER_{it-1}	5.1	2.5	0.0	20.0	4.3	2.3	0.0	20.0	DLWD
$P65_{i}$	14.2	6.1	1.3	54.5	14.2	6.1	1.3	54.5	Census 2000
PBA_{i}	31.2	16.5	0.0	76.1	31.2	16.5	0.0	76.1	Census 2000
PAA_{i}	7.2	12.6	0.0	93.6	7.2	12.6	0.0	93.6	Census 2000
PHO_{i}	73.8	17.9	0.0	97.1	73.8	17.9	0.0	97.1	Census 2000
CRI_{i}	26.1	22.5	0.0	238.3	26.1	22.5	0.0	238.3	DOT
Political Institution									
DD_{it}	0.293		0.0	1.0	0.294		0.0	1.0	LDDB
$CONSOL_{i}$	0.124		0.0	1.0	0.124		0.0	1.0	LDDB
$COORDI_{it}$	0.035		0.0	1.0	0.034		0.0	1.0	LDDB
$FMG1_{it}$	0.581		0.0	1.0	0.580		0.0	1.0	LDDB
$FMG2_{it}$	0.314		0.0	1.0	0.316		0.0	1.0	LDDB
Measures for Inter-jurisdictional Competition [2]									
COM_{it}_PM1	0.095	0.058	0.014	0.367	0.096	0.075	0.006	0.625	Calculated
COM_{it}_PM2	0.082	0.058	0.012	0.390	0.083	0.059	0.012	0.393	Calculated
COM_{it}_PM3	0.102	0.080	0.011	0.614	0.103	0.081	0.011	0.625	Calculated
COM_{it}_PM4	0.090	0.052	0.020	0.231	0.091	0.053	0.020	0.234	Calculated
MS_{it}_PM1	0.150	0.107	0.000	0.605	0.136	0.097	0.000	0.606	Calculated
MS_{it}_PM2	0.064	0.066	0.000	0.555	0.064	0.066	0.000	0.559	Calculated
MS_{it}_PM3	0.098	0.128	0.000	0.898	0.097	0.127	0.000	0.901	Calculated
MS_{it}_PM4	0.037	0.048	0.000	0.394	0.037	0.048	0.000	0.394	Calculated

Note: 1. DLGS-Division of Local Government Services in Department of Community Affairs; DLWD – Department of Labor and Workforce Development; DOE – Department of Education; DOT – Department of Transportation; LDDB – Legislative District Data Book. 2. PM1 – 1st order contiguity-based public market; PM2 – 2nd order contiguity-based public market; PM3 – Distance-based public market; PM4 – County boundary-based public market.

Chapter V. Empirical Results

The previous chapter specified four research models for examining hypotheses. This chapter presents the results of the statistical analysis of the four research models: the municipal tax rate model, the combined municipal-school district tax rate model, the hedonic property value model, and the technical efficiency model. Each research model is estimated using various multiple regression methods and either 2004 cross-sectional or 2001-2004 panel data for 566 New Jersey communities. The results for all regressions are summarized in tables 5-2, 5-3, 5-4, and 5-6.

5-1. Existence of Tax Competition

One main purpose of this study is to test whether municipalities compete with school districts (Hypothesis 1), with counties (Hypothesis 2), and with other neighboring or competing municipalities (Hypothesis 3) when setting their property tax rates. To test the hypotheses, this study proceeds in three steps. First, this study examines the spatial autocorrelation in the dependent variable, municipal property tax rates (MTR_{it}), by examining a quantile map and via Moran I statistics. Second, to select the proper spatial model, the non-spatial tax rate model (Equation 1) is estimated and, then, spatial dependence in the OLS residuals is examined by the LM statistic. Third, the selected spatial lag or error model is estimated by either the IV or the ML estimation method.

5-1-1. Spatial Autocorrelation Tests on Municipal Property Tax Rates

A. Exploratory Data Analysis by a Quantile Map

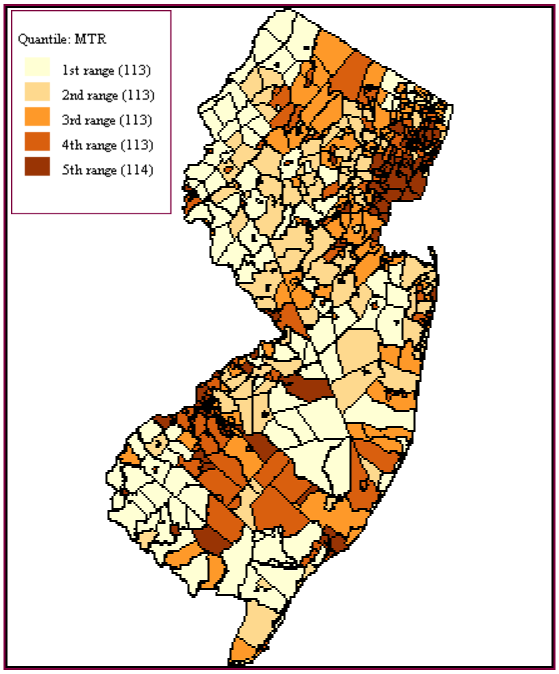
We perform a preliminary spatial autocorrelation test on the municipal property tax rate using a quantile map. Figure 5-1 illustrates the clustering of 2004 municipal, school district, county, and total property tax rates in 2004. In the quantile maps, property tax rates are sorted and grouped in five categories with equal number of observations. In the legend, the number of observation in each category is in parentheses. In quantile maps, high property tax rates municipalities are colored in darker shades of red, while low municipal property tax rates municipalities are shown in lighter shades of white.

A visual inspection of Figure 5-1 reveals a geographical pattern of municipal property tax rates. High municipal tax rate communities are concentrated in regions around Camden city and the north-eastern regions, whereas low property tax rates are concentrated in the central, north-western, and south-eastern areas. This tendency of high (low) municipal tax rate communities to be surrounded by other high (low) tax rate communities provides evidence supporting the presence of spatial dependence in municipal tax rates.

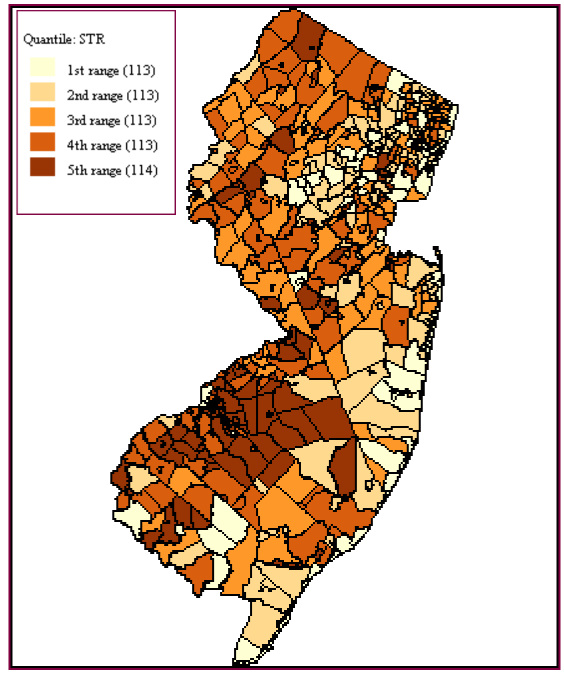
Figure 5-1 also shows spatial patterns of school districts, counties, and total property tax rates. High school district tax rate communities are concentrated in the north-western, middle-western, and around Camden regions, while low school district tax rate communities are concentrated around the Atlantic coast regions. County tax rates are clustered by county jurisdictional boundaries and the spatial distributional pattern of total tax rates are similar to that of school district tax rates.

The quantile map apparently shows that the high municipal tax rate communities tend to cluster in space and so do the low municipal tax rate communities. Although cartographic data displays are good tools for exploratory spatial data analysis, it is more useful to evaluate whether observations are spatially clustered by more formalized tests. In the following, we perform formal spatial autocorrelation tests on municipal tax rates.

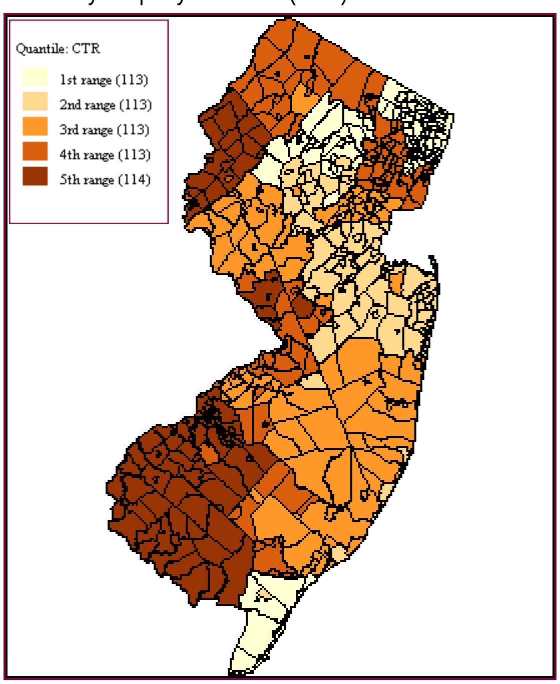
A. Municipal Property Tax Rate (MTR)



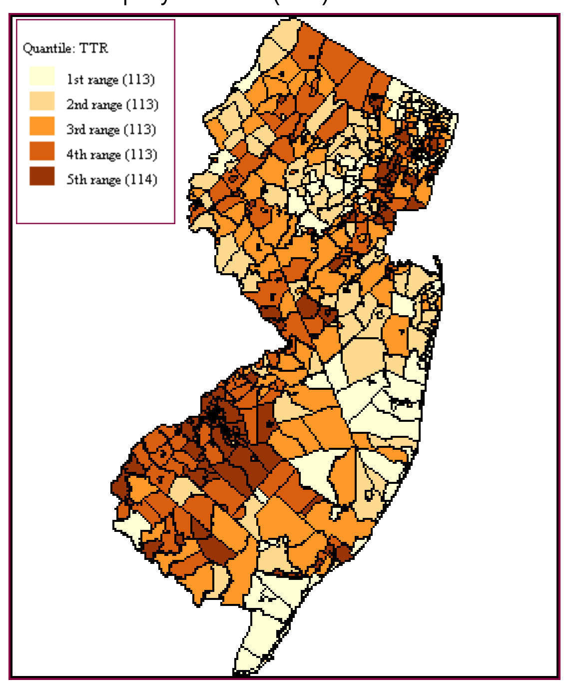
B. School District Property Tax Rate (STR)



C. County Property Tax Rate (CTR)



D. Total Property Tax Rate (TTR)



Tax Rate	Minimum	1st Range	2nd Range	3rd Range	4th Range	Maximum	Coefficient of Variation
MTR	0.000	0.250	0.372	0.515	0.699	5.666	0.831
STR	0.000	0.857	1.120	1.321	1.511	8.396	0.454
CTR	0.174	0.260	0.352	0.419	0.553	1.032	0.456
TTR	0.445	1.498	1.763	1.954	2.272	10.542	0.369

Figure 5-1. Property Tax Rates by the Type of Local Governments (2004)

B. Formal Test for Spatial Autocorrelation

We test for spatial autocorrelation in municipal property tax rates by the Moran *I* spatial autocorrelation statistic and its visualization in the form of a Moran scatter plot. Figure 5-2 provides the results of the Moran *I* statistics and the Moran scatter plots.[44] The results confirm the exploratory visual inspection of spatial dependence, showing that under all four weight matrices, Moran *I* statistics are statically different from zero. The Moran *I* statistics suggest a spatial pattern of positive autocorrelation in municipal property tax rates.

In the Moran scatter plots, the spatial lag of municipal property tax rates, which is the simple average property tax rate of neighbors, is shown on the vertical axis, while the horizontal axis portrays the value of each municipality's property tax rate. In the scatter plot, the municipal property tax rates are standardized so that the units on the graph correspond to standard deviations.

The four quadrants in the graph provide a classification of four types of spatial autocorrelation: the top right and the bottom left quadrants for positive spatial autocorrelation; the top left and the bottom right quadrants for negative spatial autocorrelation. The top right quadrant represents municipalities that have relatively high property tax rates, surrounded with municipalities that also have high property tax rates. The bottom left quadrant represents municipalities that have relatively low property tax rates and are surrounded by municipalities with similarly low property tax rates.

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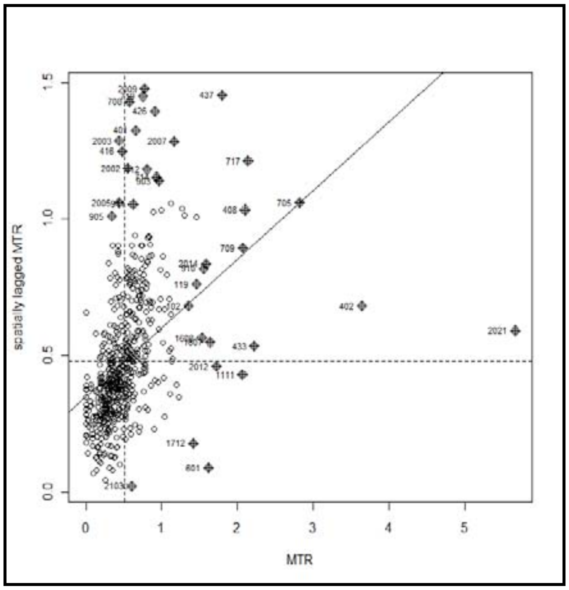
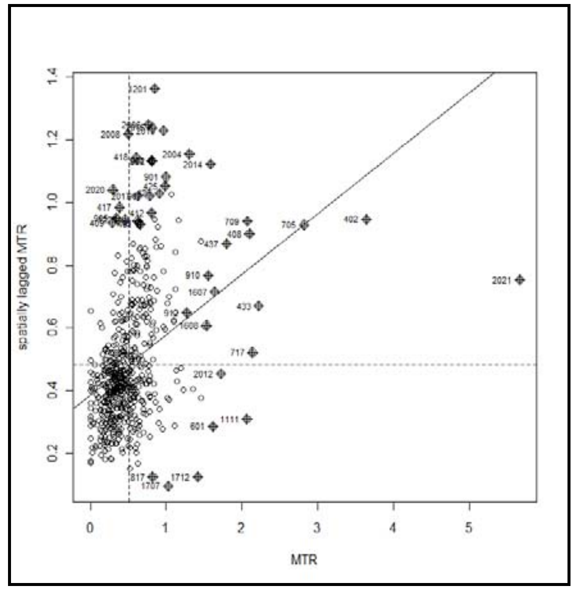
44. Moran *I* statistics can be calculated based either on randomization or on a normality assumption. Literature suggests that assuming a normal distribution for the Moran *I* is often an incorrect assumption (for example, Boots and Tiefelsdorf, 2000). Therefore, the Moran *I* statistics in Figure 5-2 is calculated based on a random permutation procedure by spdep in R. In the randomization approach, the Moran *I* statistics are recalculated many times to generate a reference distribution. Then, the calculated statistic is compared to the reference distribution and a significance level is calculated (Anselin, 2005).

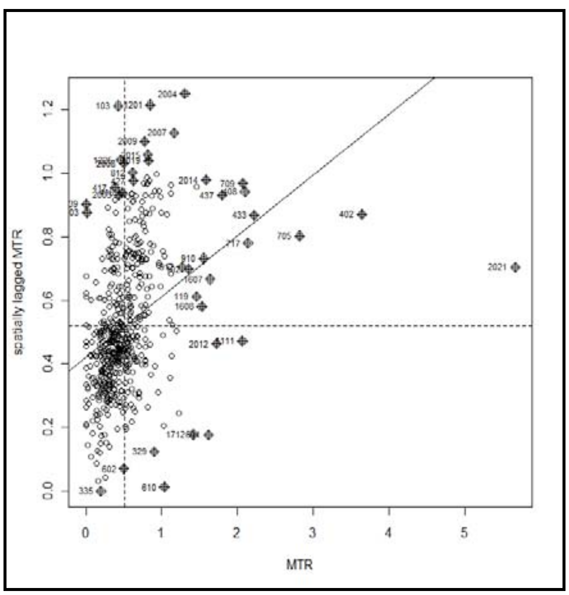
A. First-order Contiguity



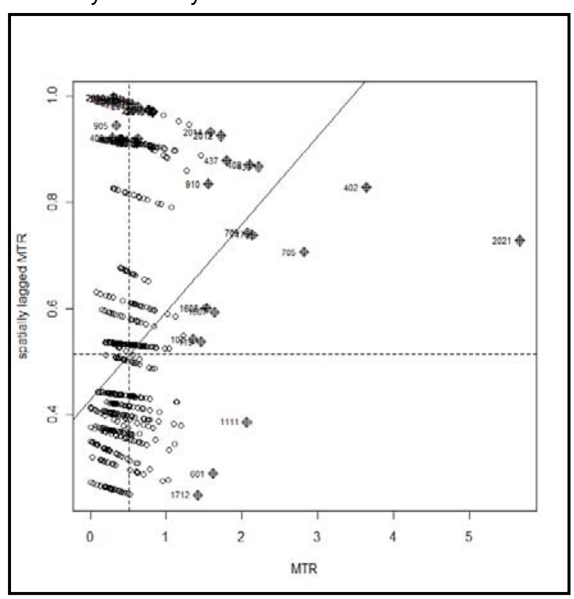
B. Second-order Contiguity



C. Euclidean Distance



D. County Boundary



Weights	Moran I	Standard Deviation	Variance	p-value
First-order Contiguity (W1)	0.2519	9.2423	0.0008	0.0000
Second-order Contiguity (W2)	0.1926	11.6412	0.0003	0.0000
Euclidean Distance (W3)	0.1914	10.038	0.0004	0.0000
County Boundary (W4)	0.1653	15.2002	0.0001	0.0000

Figure 5-2. Moran I Statistics and Moran Scatter Plot for Municipal Property Tax Rates (2004)

Figure 5-2 also portrays the OLS regression lines, which produce a summary measure of the relationship between a municipality's property tax rate and its competitors' average property tax rates. The slopes of the OLS lines are the Moran *I* statistics for municipal property tax rates under four different weight matrices predetermined based on the four criteria in Chapter IV. The calculated Moran *I*s are 0.2519, 0.1926, 0.1914, and 0.1653, with p values of 0.000. This indicates that there is a positive spatial dependence in municipal property tax rates under all four definitions of public market.

5-1-2. Spatial Regression Analysis

A. Spatial Autocorrelation Test on OLS Residuals

To determine the proper spatial model, we use LM and robust LM tests on the OLS residuals of the non-spatial municipal tax rate model (Equation 1). As suggested in Chapter IV, the county property tax rate (CTR_{it}) and the school district property tax rate (STR_{it}) are suspected to be endogenous. To solve the endogeneity issue, we first regress county and school district tax rates on exogenous explanatory variables and three instrumental variables. The instruments are one year lagged school district tax rates (STR_{it-1}), one year lagged county population ($POPC_{it-1}$), one year lagged county property tax levy ($PCTL_{it-1}$), and one year lagged county personal income ($INCC_{it-1}$). In the second stage, the fitted values of county property tax rates (CTR_{it}_HAT) and school district property tax rates (STR_{it}_HAT) are used in Equation 1 to obtain OLS residuals.[45]

45. This process is done manually because the spatial regression package spdep in R does not have a built-in function for IV or 2SLS estimation. Although the manually calculated OLS residuals are different from those produced by the installed function for IV or 2SLS in STATA, the correlation coefficient between them is over 0.96. The outputs of the first stage regression are provided in Appendix A.

We calculate, for each of the four weight matrices, LM test statistics on the OLS residuals of the non-spatial municipal tax rate model. Based on LM and robust LM statistics, we conclude that a spatial lag model is the proper spatial model under the first-order contiguity, the second-order contiguity, and the Euclidean distance weights matrices, while a spatial error model is the preferred model under the county boundary weight matrix. Table 5-1 reports five LM statistics by weight matrix.

Under both the first-order contiguity and the Euclidean distance weight matrices, the LM lag statistics are statistically significant (p = 0.009 and 0.03, respectively) while the LM error statistics are not significant (p = .122 and .437, respectively). On the other hand, both LM error and LM lag statistics are statistically significant under the second-order contiguity weight matrix. Of the robust forms, the robust LM lag statistic is significant (p = .004), but the robust LM error is insignificant (p = .45). As a result, it is concluded that spatially lagged dependent variable is the relevant source of spatial dependence when we define a public market based on the first-order contiguity, the second-order contiguity, and the Euclidean distance.

However, a spatial error model is identified as the proper model under the county boundary-based weight matrix. Although robust LM statistics both for spatial lag dependence and for spatial error dependence are statistically significant, the robust LM error statistics (15.197 with p value of 0.000) is greater and more statistically significant than the robust LM lag statistic (3.876 with p value of 0.049). This indicates that the spatial dependence is caused by spatially lagged errors. However, unlike under other weight matrices, the robust LM lag statistic is still highly significant. This suggests that spatial dependence exists both in the dependent variable and in the error term and, thus, the proper model may be a spatially autoregressive and moving average (SARMA) model.

Table 5-1. Spatial Autocorrelation in Residuals of the Non-spatial Municipal Tax Rate Model

Weight Matrix:	W1	W2	W3	W4
LM for Spatial Lag Dependence	6.851 (0.009)	19.242 (0.000)	4.738 (0.030)	22.562 (0.000)
LM for Spatial Error Dependence	2.394 (0.122)	11.354 (0.001)	0.605 (0.437)	33.884 (0.000)
Robust LM for Spatial Lag Dependence	4.856 (0.028)	8.460 (0.004)	5.097 (0.024)	3.876 (0.049)
Robust LM for Spatial Error Dependence	0.399 (0.528)	0.571 (0.450)	0.964 (0.326)	15.197 (0.000)
LM for SARMA	7.250 (0.027)	19.813 (0.000)	5.702 (0.058)	37.760 (0.000)

Weights matrices: W1=First order contiguity, W2=Second order contiguity, W3=Distance weights, and W4=County weights

B. Spatial Regression Analysis

This sub-section presents the results of regression analysis examining the existence of inter-municipal competition and intra-jurisdictional competition between municipalities and school districts and between municipalities and counties in setting property tax rates. Based on the LM tests, we identified proper spatial models between the spatial lag and the spatial error models. The selected spatial lag model or the spatial error model is estimated using data on property tax rates of 566 New Jersey municipalities in 2004.

Table 5-2 reports the regression results of the municipal tax rate models (Equation 1, 2, and 3). The first column presents the two-step IV estimation results of the non-spatial municipal tax rate model whose residuals are used to compute the LM statistics.In the columns from second to fourth, we present the Baum, Schaffer, and Stillman's (2007) IV GMM estimation results of the spatial lag municipal tax rate models. The Kelejian and Prucha's (1999) GMM estimation results of the spatial error municipal tax rate model are reported in the fifth column.

a. Spatial lag model

As we discussed in the Chapter IV, the spatially lagged dependent variable ($\boldsymbol{W}MTR_{it}$), school district tax rates (STR_{it}), and county tax rates (CTR_{it}) are endogenous. In order to solve the endogeneity issue, we can use either the IV or the ML method in estimating the spatial lag model. We use the IV approach since the ML estimation method cannot be used when explanatory variables other than the spatially lagged dependent variable are endogenous. The estimation of the spatial lag model is implemented by the Baum, Schaffer, and Stillman's (2007) IV GMM estimation method in Stata.

The IV regression results of the spatial lag tax rate setting model (Equation 2) show that Hansen's J of over-identification, Kleibergen-Paap of under-identification, and F-values of first stage regressions do not reject the validity of the instrument variables with a reasonable degree of confidence. However, Breusch-Pagan and Pagan-Hall tests show that heteroskedasticity is present. The Huber-White-sandwich estimator of variance is used to produce valid standard errors in the presence of heteroskedasticity. The outputs of first stage regression for spatially lagged dependent variable, school district tax rates, and county tax rates are presented in Appendix B.[46]

b. Spatial error model

The spatial error model (Equation 3) is estimated by Kelejian and Prucha's (1999) GMM approach which is consistent even with the non-normality of the error term. Since

46. The list of instruments for the three endogenous variables include all exogenous regressors, one year lagged school district tax rates (STR_{it-1}), one year lagged county population ($POPC_{it-1}$), one year lagged county property tax levy ($PCTL_{it-1}$), one year lagged county personal income ($INCC_{it-1}$), and spatially lagged variables of municipal property tax levy ($PMTL_{it-1}$), municipal population (POP_{it_1}), square of municipal population ($POPS_{it\_1}$), municipal population density ($POPD_{it\_1}$), poverty rate (POV_{it_1}), residential building permits (POV_{it_1}), percent of African-American population (PAA_{it-4}), percent of population age over 65 ($P65_{it-4}$), percent of homeownership (PHO_{it-4}), and crime rate (CRI_{it-4}).

the Jarque-Bera test on residuals of the non-spatial municipal tax rate model (Equation 1) rejects the null hypothesis of a normally distributed error term (27,804.64 with *p*-value of 0.000), we cannot estimated the spatial error model by the ML estimation method. In addition, the IV approach is not appropriate for obtaining a consistent estimator for the spatial autocorrelation coefficient in a spatial error model (Kelejian and Prucha, 1997).

The results of the spatial error model estimated by GMM shows that the spatial autoregressive error coefficient is estimated as 0.409, and is highly significant. This indicates that the spatial dependence in the municipal tax rates is caused by the spatially autocorrelated omitted variables. The results also show that the spatial error model performs better than the non-spatial municipal tax rate model. If we compare the values for the spatial error model in column 5 to those in column 1, we notice an increase in the Log-Likelihood from -65.4 for the non-spatial model to -55.3 for spatial error model by GMM.

C. Existence of Intra-jurisdictional Competition

The regression results of the municipal tax rate models provide strong evidence supporting both Hypothesis 1 and Hypothesis 2, showing that the coefficient on the school district tax rates (STR_{it}) and the county tax rates (CTR_{it}) are highly significant across the four weight matrices. However, the municipality responds differently to tax rates of school districts and counties. While county tax rates have a negative effect on the municipal property tax rates, the school district property tax rates are positively related to the municipal tax rates.

The consistently positive and significant coefficients of school district tax rates across four different weight matrices suggests that municipal and school district property tax rates are strategic complements: an increase in the school district tax rate leads to increases in the municipal tax rate. The estimated coefficients suggest that \$1 increase in the school district property tax rate induces the municipality to increase its property tax rate by \$0.190 - \$0.387.

The consistently negative and significant coefficient of county tax rates across four weight matrices indicates that municipal governments decrease their tax rates in reaction to an increase in county property tax rates. The estimated coefficients indicate that \$1 increase in the county property tax rate leads to a fall of \$0.273 - \$0.382 in the municipal government property tax rate. The results can be explained such that a higher county tax rate makes it more difficult for the municipalities to raise revenues from the same base.

D. Existence of Inter-jurisdictional Competition

The IV regression results of the spatial lag model confirm Hypothesis 3, showing that the coefficients on the spatially lagged dependent variable ($\boldsymbol{W}MTR_{it}$) are statistically significant under the first-order contiguity, the second-order contiguity, and the Euclidean distance weight matrices. The estimated coefficients on the spatially lagged dependent variable ($\boldsymbol{W}MTR_{it}$) indicate that municipalities do behave strategically with other neighboring or competing municipalities in setting property tax rates. Under three different weight matrices, the estimated coefficients suggest that a municipality would respond to a \$1 increase in its neighbors' tax rates by raising its tax rates between about \$0.205 and \$0.286.

As stated above, it is suggested that the proper spatial model may be the SARMA model under county boundary-based weight matrix. We test whether both coefficients on the spatially lagged dependent variable and the spatially lagged error term are significant.[47] The results of the SARMA model confirm Hypothesis 3, showing that both coefficients on the spatial lag and spatial error are highly significant. The results also mean that when we define the public market based on the county boundary, the proper model may be the SARMA model. The regression output of the SARMA model is presented in Appendix C.

E. Control Variables

The coefficients of control variables generally show the expected signs and are consistent in terms of their sign and statistical significance across four different weight matrices. Although the coefficient of the dummy for the elected governing body-administrator form of municipal government ($FMG2_{it}$) shows different signs across four weight matrices, it is not statistically significant at the conventional significance level. The unemployment rate (UER_{it}) and the dummy for school district consolidation ($CONSOL_{it}$) do not have any statistically significant effects on municipal tax rates across all weight matrices.

The regression results shows that while population (POP_{it-1}) and population density ($POPD_{it-1}$) have consistent positive effects, squared population ($POPS_{it-1}$) has consistent negative effect. This indicates that decreasing economies of scale are present in the provision of public goods. The per capita property tax levy ($PMTL_{it-1}$), the poverty rate (POV_{it-1}), personal income (INC_{it-1}), and the percent of African Americans (PAA_{it-4})

47. For estimating the SARMA tax rate setting model, we first regress the spatially lagged dependent variable ($\boldsymbol{W}MTR_{it}$), school district tax rates (STR_{it}), and county tax rates (CTR_{it}) on the spatially lagged variables of exogenous exploratory variables ($\boldsymbol{W}X_{it-k}$), county and school district demographic variables, and all exogenous exploratory variables (X_{it-k}). Then, the fitted values of spatially lagged dependent variable ($\boldsymbol{W}MTR_{it}\_HAT$), county property tax rates (CTR_{it}_HAT), and school district property tax rates (STR_{it}_HAT) are used to estimate the spatial error tax rate setting model by using Kelejian and Prucha's (1999) GMM in spdep package in R.

have consistent positive effects on municipal tax rates. The number of residential building permits (RBP_{it-1}) and the percent of the population with a BA or higher degree (PBA_{it-4}) are negatively related to municipal property tax rates across all weight matrices.

The percent of senior population ($P65_{it-4}$), the crime rate (CRI_{it-4}), a dummy for elected governing body and the chief executive form of municipal government ($FMG1_{it}$), and a dummy for direct democracy institution of municipal government (DD_{it}) have consistent positive effects but statistically significant under only some weight matrices. The percent of home ownership (PHO_{it-4}) and a dummy for the municipality with the Type II school district ($INTRA_{it}$) are negatively related to municipal tax rates but the statistical significance differs by the weight matrix.

Table 5-2. Results of Municipal Tax Rate Models (2004)

Dependent: MTR_{it}	Non-Spatial (IV)	Spatial Lag (IV, GMM)			Spatial Error (GMM)
Weight Matrix	No	W1	W2	W3	W4
$WMTR_{it}$		0.205 (0.064)***	0.259 (0.064)***	0.286 (0.067)***	
STR_{it}	0.387 (0.028)***	0.193 (0.076)**	0.204 (0.082)**	0.190 (0.092)**	0.377 (0.029)***
CTR_{it}	-0.349 (0.112)***	-0.286 (0.087)**	-0.273 (0.084)***	-0.324 (0.087)***	-0.382 (0.154)**
$PMTL_{it-1}$	0.022 (0.006)***	0.023 (0.011)***	0.016 (0.011)	0.027 (0.012)**	0.018 (0.006)***
$PMSA_{it-1}$	-0.146 (0.055)***	-0.170 (0.110)	-0.097 (0.114)	-0.222 (0.118)*	-0.114 (0.053)**
POP_{it-1}	0.003 (0.001)**	0.003 (0.001)***	0.002 (0.001)**	0.002 (0.001)**	0.002 (0.001)*
$POPS_{it-1}$	-1.0e-5 (5.7e-6)*	-1.3e-5 (3.7e-6)***	-1.1e-5 (3.7e-6)***	-1.2e-5 (3.9e-6)***	-7.7e-6 (5.5e-6)
$POPD_{it-1}$	0.020 (0.003)***	0.015 (0.005)***	0.015 (0.004)***	0.014 (0.004)***	0.019 (0.003)***
INC_{it-1}	0.004 (0.001)***	0.002 (0.001)***	0.002 (0.001)***	0.002 (0.001)***	0.003 (0.001)***
POV_{it-1}	0.020 (0.004)***	0.026 (0.006)***	0.024 (0.006)***	0.031 (0.006)***	0.021 (0.004)***
RBP_{it-1}	-3.8e-4 (1.3e-4)***	-3.8e-4 (1.1e-4)***	-3.4e-4 (1.0e-4)***	-3.7e-4 (1.0e-4)***	-3.8e-4 (1.2e-4)***
UER_{it-1}	0.002 (0.007)	0.002 (0.007)	0.003 (0.007)	-0.006 (0.007)	0.005 (0.008)
$P65_{it-4}$	0.008 (0.002)***	3.9e-4 (2.8e-3)	9.3e-4 (2.8e-3)	9.8e-4 (3.3e-3)	6.4e-3 (2.2e-3)***
PBA_{it-4}	-0.005 (0.001)***	-0.004 (0.001)***	-0.004 (0.001)***	-0.005 (0.001)***	-0.005 (0.001)***
PAA_{it-4}	0.004 (0.001)***	0.003 (0.002)*	0.004 (0.002)**	0.003 (0.002)	0.004 (0.001)***
PHO_{it-4}	-3.3e-3 (1.0e-3)***	-3.3e-4 (1.5e-3)	-9.9e-4 (1.2e-3)	-2.5e-3 (1.5e-3)*	-3.6e-3 (1.0e-3)***
CRI_{it-4}	0.002 (0.001)***	0.001 (0.001)	0.001 (0.001)	0.000 (0.001)	0.001 (0.001)**
DD_{it}	0.041 (0.032)	0.036 (0.022)	0.051 (0.022)**	0.047 (0.023)**	0.055 (0.031)*
$CONSOL_{it}$	-0.050 (0.037)	-0.012 (0.025)	-0.011 (0.025)	-0.014 (0.025)	-0.055 (0.036)
$INTRA_{it}$	-0.106 (0.068)	-0.188 (0.076)**	-0.154 (0.081)*	-0.110 (0.078)	-0.101 (0.067)
$FMG1_{it}$	0.064 (0.043)	0.065 (0.037)*	0.064 (0.037)*	0.066 (0.039)*	0.057 (0.042)
$FMG2_{it}$	0.007 (0.048)	-0.019 (0.043)	-0.016 (0.043)	0.012 (0.045)	0.023 (0.047)
Constant	0.204 (0.153)	0.320 (0.213)	0.286 (0.219)	0.468 (0.224)*	0.278 (0.153)
λ					0.409 (0.000)***
F for $WMTR_{it}$		53.8 (0.000)	58.2 (0.000)	62.1 (0.000)	
F for STR_{it}	212.7 (0.000)	123.1 (0.000)	192.9 (0.000)	175.4 (0.000)	212.7 (0.000)
F for CTR_{it}	43.6 (0.000)	68.6 (0.000)	83.7 (0.000)	63.2 (0.000)	43.6 (0.000)
Kleibergen-Paap		115.5 (0.000)	162.5 (0.000)	161.2 (0.000)	
Hansen's J		11.8 (0.381)	15.1 (0.180)	18.6 (0.070)	
Breusch-Pagan	766.1 (0.000)	2058.1 (0.000)	2380.3 (0.000)	1934.7 (0.000)	
Pagan-Hall		85.3 (0.000)	109.1 (0.000)	84.3 (0.000)	
N of Observation	566	566	566	566	566
R^2/LL	-65.4	0.563	0.582	0.567	-55.3

Notes: 1. Weights matrices: W1=1st order contiguity, W2=2nd order contiguity, W3=distance, W4=county. 2. Instruments for $WMTR_{it}$, STR_{it}, and CTR_{it} are STR_{it-1}, $PCTL_{it-1}$, $POPC_{it-1}$, $INCC_{it-1}$, spatially lagged variables of $PMTL_{it-1}$, POP_{it-1}, $POPS_{it-1}$, $POPD_{it-1}$, POV_{it-1}, RBP_{it-1}, $P65_{it-4}$, PAA_{it-4}, PHO_{it-4}, and CRI_{it-4}. 3. *, **, and *** denote statistical significance at the 0.10, 0.05, and 0.01 levels, respectively. 4. Except for non-spatial regression, standard errors in parenthesis are robust to heteroskedasticity. 5. First-stage F statistics are robust to heteroskedasticity and p-values are in parenthesis. 6. For spatial error model, coefficient of spatial autoregressive process in the error term (λ), its p-value in parenthesis, and Log Likelihood (LL) statistics are provided. 7. Kleibergen-Paap's rk statistics for underidentification are robust to heteroskedasticity. 8. Hansen's J statistics for overidentification are consistent in the presence of heteroskedasticity. 9. Breusch-Pagan test for OLS and Pagan-Hall general test for 2SLS are used to test for homoskedasticity.

5-2. Effect of Competition on Property Tax Rates

This section presents the results of the combined municipal-school district tax rate model (Equation 4) examining the effects of inter-jurisdictional competition (Hypothesis 4), market share (Hypothesis 7), school district consolidation (Hypothesis 8), and intra-jurisdictional competition (Hypothesis 11) on property tax rates. The combined tax rate model is estimated using the Generalized Estimating Equations (GEE) method and data on 566 communities in New Jersey for the years 2001 to 2004. The regression results provide evidence supporting Hypothesis 4, Hypothesis 8, and Hypothesis 11, but little evidence of asymmetric tax competition (Hypothesis 7).

A. Overview of the Regression Results

The regression diagnostics show that there is evidence of severe first order serial correlation and heteroskedasticity. The Wooldridge' first order serial correlation test for panel data show that we cannot reject the null hypothesis under all four definitions of a public market. Furthermore, the Breusch-Pagan test for heteroskedasticity indicates that the error term is heteroskedastic under all four definitions of public market. To overcome these two issues, we estimate the combined tax rate model by using the GEE method.[48]

Alternatively, we also estimate the combined tax rate model by a random-effects model with Rogers' standard errors which are robust to heteroskedasticity and autocorrelation. The regression outputs of the random-effects estimation are provided in

48. The literature provides several alternative methods such as panel-corrected standard errors (PCSEs) and feasible generalized least squares (FGLS) for panel data as the solution to serial correlation and heteroskedasticity (Beck and Katz, 1995). These methods, however, work best when the number of time points is greater than the number of cross-sections or panels. Because this study analyzes property tax rates of 566 communities from 2001-2004, the number of panels is much greater than the number of time points, so PCSEs and FGLS are not appropriate.

Appendix D. The results are consistent across the two estimation methods with an exception of the coefficient on the dummy variable for communities with the Type II school district ($INTRA_{it}$). Although the signs of coefficients on population (POP_{it-1}), population density ($POPD_{it-1}$), and the percent of student (PSD_{it-1}) are not consistent between the GEE and the random-effects with Rogers standard errors approach, all of them are not statistically different from zero.

B. Effect of Inter-jurisdictional Competition

The results of the combined tax rate model provide strong evidence supporting Hypothesis 4 that the degree of inter-jurisdictional competition has a negative effect on the property tax rate. The estimated coefficient of the degree of inter-jurisdictional competition (COM_{it}) is negative and statistically significant across all four definitions of a public market. The coefficient indicates that an increase in governmental units per 1000 persons reduces the combined municipal-school district property tax rate by \$0.421 – \$2.128. The results are consistent with the theoretical prediction of four inter-jurisdictional competition theories that inter-jurisdictional competition leads to lower tax rates.

C. Effect of Market Share

The regression results of the combined municipal-school district tax rate model show little evidence to support the theoretical argument from asymmetric tax competition that relatively larger jurisdictions tend to have higher tax rates than smaller competing jurisdictions (Hypothesis 7). While the market share (MS_{it}) has an expected positive and statistically significant effect on the combined tax rate under the second-order contiguity based a public market, it has negative but not statistically significant effect under all other definitions of a public market.

D. Effect of Local Government Consolidation

The results of the combined tax rate model provide strong evidence supporting the school district consolidation hypothesis (Hypothesis 8) that the property tax rate is lower in the community which is a member of a consolidated school district. The coefficient on the dummy variable for school district consolidation ($CONSOL_i$) is negative and statistically significant at the 10% significance level under all four definitions of a public market. The estimated coefficients indicate that the property tax rates in the community which is a member of a consolidated school district are lower by about \$0.118 – \$0.136 than in the community with a regular school district. This supports Oates' (1972) view that small government consolidation is associated with lower tax rates due to economies of scale, while rejecting the tax competition theory that the mergers of small jurisdiction results in higher tax rates.

E. Intra-jurisdictional Competition v.s. Budget Referendum

Because the dummy variable for the intra-jurisdictional competition ($INTRA_{it}$) reflects two institutions of the budget referendum and the intra-jurisdictional competition and their effects are opposite, we develop a conditional hypothesis about the effect of intra-jurisdictional competition on the tax rate. The econometric results of the combined tax rate model provide evidence supporting the dominance of the budget referendum effect that property tax rates are lower in communities with Type II school districts if the budget referendum effect outweighs the intra-jurisdictional competition effect (Hypothesis 11).

The coefficient on the communities with Type II school districts (*$INTRA_i$*) is positive and statistically significant under all four definitions of a public market. The estimated coefficients indicate that property tax rates in the community with the Type II school district are lower by about \$1.096 – \$1.102 than in the communities with the Type I school district. However, this result is not confirmed by the results of random-effects estimation, which shows that the coefficient is never statistically significant under all four definitions of a public market (see Appendix D).

F. Control Variables

Most control variables have the expected effects on the combined tax rates and are statistically significant at the conventional level. In addition, the coefficients of control variables are consistent across four definitions of a public market. No coefficients are positive and significant in one definition of public market but negative and significant in another definition. However, state aid to school districts per capita ($PSSA_{it-1}$), population density ($POPD_{it-1}$), personal income (INC_{it-1}), the percent of resident pupils (PSD_{it-1}), and the dummy for direct democracy institution of municipality (DD_{it}) are never significant across the four definitions of a public market.

The log of municipal property tax levy per capita ($PMTL_{it-1}$), the log of school district property tax levy per capita ($PSTL_{it-1}$), the log of poverty rate (Ln_POV_{it-1}), and the percent of African-Americans (PAA_i) have positive and statistically significant effects on the combined tax rates across the four definitions of a public market. On the other hand, state aid to municipalities per capita ($PMSA_{it-1}$), the number of residential building permits (RBP_{it-1}), the unemployment rate (UER_{it-1}), the percent of seniors ($P65_i$), the percent of population with a BA or higher (PBA_i), the percent of homeownership (PHO_i),and the dummy for the elected governing body and chief executive form of municipal government ($FMG1_{it}$) have negative and statistically significant effects on the combined tax rates under the four definitions of public market.

The effect of population (POP_{it-1}) differs by the definition of a public market. The coefficient in positive under county boundary-based public market but it is negative in all other definitions of public market. However, the coefficient is not statistically different from zero with the exception of the second-order contiguity based public market. The coefficients of dummy variables for years are negative and statistically significant across all definitions of public market. As shown in Chapter II, the downward trend of property tax rates throughout the period may be caused by the consistent increase in property values.

Table 5-3. Results of Combined Municipal-School District Tax Rate Model by GEE (2001-2004)

Dependent Variable: $MSTR_{it}$	Public Market			
	PM1	PM2	PM3	PM4
COM_{it}	-0.421 (0.243)*	-2.128 (0.616)***	-1.475 (0.495)***	-1.792 (0.888)**
MS_{it}	-0.074 (0.120)	0.701 (0.326)**	-0.269 (0.166)	-0.827 (0.688)
$CONSOL_i$	-0.128 (0.072)*	-0.125 (0.070)*	-0.118 (0.068)*	-0.136 (0.075)*
$INTRA_{it}$	-1.096 (0.547)**	-1.102 (0.556)**	-1.096 (0.558)**	-1.097 (0.557)**
CTR_{it}	0.943 (0.122)***	0.973 (0.132)***	0.966 (0.132)***	0.967 (0.130)***
Ln_PMTL_{it-1}	0.076 (0.024)***	0.074 (0.023)***	0.065 (0.021)***	0.075 (0.022)***
Ln_PSTL_{it-1}	0.276 (0.081)***	0.274 (0.086)***	0.261 (0.086)***	0.270 (0.085)***
$PMSA_{it-1}$	-0.185 (0.066)***	-0.181 (0.066)***	-0.175 (0.067)***	-0.187 (0.066)***
$PSSA_{it-1}$	0.141 (0.097)	0.129 (0.098)	0.148 (0.099)	0.147 (0.098)
POP_{it-1}	-2.9e-4 (1.1e-3)	-0.002 (0.001)*	-7.4e-4 (1.2e-3)	3.5e-4 (2.1e-3)
$POPD_{it-1}$	0.001 (0.010)	-0.002 (0.011)	-0.004 (0.011)	-0.004 (0.011)
INC_{it-1}	-0.002 (0.002)	-0.002 (0.002)	-0.002 (0.002)	-0.002 (0.002)
Ln_POV_{it-1}	0.022 (0.009)**	0.023 (0.009)**	0.023 (0.009)**	0.023 (0.009)**
RBP_{it-1}	-6.8e-5 (3.5e-5)*	-7.8e-5 (3.4e-5)**	-7.1e-5 (3.5e-5)**	-6.8e-5 (3.5e-5)*
UER_{it-1}	-0.044 (0.012)***	-0.042 (0.013)***	-0.042 (0.013)***	-0.041 (0.013)***
PSD_{it-1}	0.003 (0.007)	0.004 (0.007)	0.004 (0.007)	0.004 (0.007)
$P65_i$	-0.024 (0.006)***	-0.024 (0.006)***	-0.024 (0.006)***	-0.025 (0.006)***
PBA_i	-0.012 (0.003)***	-0.013 (0.003)***	-0.013 (0.003)***	-0.013 (0.003)***
PAA_i	0.008 (0.004)**	0.008 (0.004)**	0.007 (0.004)**	0.008 (0.004)**
PHO_i	-0.012 (0.007)*	-0.011 (0.007)*	-0.011 (0.007)*	-0.012 (0.007)*
CRI_i	-0.006 (0.002)**	-0.006 (0.002)**	-0.006 (0.002)**	-0.006 (0.003)**
DD_{it}	-0.031 (0.032)	-0.029 (0.031)	-0.015 (0.030)	-0.024 (0.032)
$FMG1_{it}$	-0.078 (0.038)**	-0.072 (0.038)*	-0.081 (0.037)**	-0.088 (0.038)**
$FMG2_{it}$	-0.204 (0.097)**	-0.165 (0.102)	-0.145 (0.109)	-0.177 (0.106)*
Year 2002	-0.028 (0.009)***	-0.030 (0.009)***	-0.029 (0.009)***	-0.030 (0.009)***
Year 2003	-0.047 (0.023)**	-0.051 (0.025)**	-0.049 (0.024)**	-0.052 (0.025)**
Year 2004	-0.133 (0.028)***	-0.140 (0.030)***	-0.136 (0.030)**	-0.140 (0.030)***
Constant	4.603 (0.844)***	4.695 (0.858)***	4.686 (0.854)***	4.775 (0.891)***
Autocorrelation	52.2 (0.000)	49.7 (0.000)	49.6 (0.000)	47.7 (0.000)
Heteroskedasticity	1542.0 (0.000)	1612.8 (0.000)	1687.0 (0.000)	1748.5 (0.000)
N of Observation	2264	2264	2264	2264
Wald x^2	1253.0 (0.000)	1132.9 (0.000)	1169.1 (0.000)	1127.7 (0.000)

Notes: 1. *, **, and *** denote statistical significance at the 0.10, 0.05, and 0.01 levels, respectively. 2. Standard errors robust to first order autocorrelation and heteroskedasticity are in parenthesis. 3. Breusch-Pagan test for heteroskedasticity is based on pooled-OLS and p-values are in parenthesis. 4. Serial correlation is tested by Wooldridge test for panel data and p-values are in parenthesis.

5-3. Effect of Competition on Allocative Efficiency

This section provides the regression results of the hedonic property value model (Equation 5) examining the effect of inter-jurisdictional competition (Hypothesis 5), school district consolidation (Hypothesis 9), and intra-jurisdictional competition (Hypothesis 12) on local government allocative efficiency. Using data on 566 communities in New Jersey in 2004, the hedonic property value model is estimated by OLS and the standard error of the estimates is corrected due to the heteroskedastic error term.[49] The OLS results of the hedonic property value model provide strong evidence of Hypothesis 12, some evidence of Hypothesis 5, and no evidence of Hypothesis 9.

A. Effect of Inter-jurisdictional Competition

The OLS regression results of the hedonic property value model presented in Table 5-4 provide some evidence supporting the hypothesis that inter-jurisdictional competition has an impact on government allocative efficiency (Hypothesis 5). The coefficient on the number of municipalities within a public market per 1000 persons (COM_{it}) is positive across four definitions of a public market but statistically significant under public markets defined by the first-order contiguity and the county boundary. The coefficient indicates that 1% increase in COM_{it} is associated with a 0.085% – 0.109% increase in the total equalized property value of a community.

There are two contrasting perspectives on the effect of inter-jurisdictional competition on government allocative efficiency. While Tiebout, the Leviathan hypothesis, and the yardstick competition theory suggest that inter-jurisdictional

49. The model is also estimated by the GEE and the random-effects model with Rogers standard errors using a panel data set for the period from 2001-2004 (see Appendix E and F).

competition makes local governments responsive and accountable to the public interests, the conventional tax competition theory formally demonstrates that inter-jurisdictional competition results in allocative inefficiency. Although the statistical significance of the coefficient differs by the definition of public market, the findings provide some evidence supporting the optimistic view on inter-jurisdictional competition that competition among local governments enhances government allocative efficiency.

B. Effect of School District Consolidation

The OLS results of the hedonic property value model provide no evidence of the school district consolidation hypothesis that there is a difference in allocative efficiency between communities which are member of a consolidated school district and communities with the regular school district (Hypothesis 9). Although the coefficient on the dummy variable for school district consolidation ($CONSOL_{it}$) is negative as expected, it is not statistically different from zero under the four definitions of a public market.

C. Intra-jurisdictional Competition v.s. Budget Referendum

The OLS results of the hedonic property model also provide strong evidence supporting the dominance of budget referendum effects that allocative efficiency is higher in communities with Type II school districts if the budget referendum effect outweighs the intra-jurisdictional competition effect (Hypothesis 12). The coefficient on the dummy for communities with Type II school districts ($INTRA_{it}$) is positive and statistically significant under the four definitions of a public market. The estimated coefficient can be interpreted as suggesting that, on average, the equalized property values of a community with the Type II school district are higher than a community with the Type I school district by about \$14,500 - \$16,700.

D. Control Variables

The OLS results of the hedonic property value model are highly consistent across four definitions of a public market, in terms of the sign, the magnitude, and the statistical significance of coefficients. The one exception is market share (MS_{it}), but its coefficient is not statistically different from zero under all definitions of public market. Furthermore, the coefficients of control variables retain the expected signs with the exceptions of the log of state aid to municipalities and school districts (Ln_MSSA_{it-1}), the log of median number of rooms (Ln_MNR_{it-4}), and the log of the crime rate (Ln_CRI_{it-4}). However, the latter two variables are not statistically significant at the conventional confidence level.

Contrary to expectations, the coefficient on state aid is negative and statistically significant under all definitions of a public market. This may be explained by the calculation of state aid to school districts, which is inversely related to the equalized value of taxable property. In addition, the results are consistent with other studies estimating the Brueckner's (1979, 1982) model such as Brueckner (1982), Deller (1990), Taylor (1995), and Bates and Santerre (2003).

The results in Table 5-4 show that while the log of housing stocks (Ln_HOS_{it}), the log of personal income (Ln_INC_{it-1}), and the log of residential building permits (Ln_RBP_{it-1}) have consistent positive effects, the log of percent of housing built before 1970 (Ln_HB70_{it-4}), population growth ($POPG_{it-1}$), and the log of poverty rate (Ln_POV_{it-1}) have the opposite effect on the property value. However, the log of commercial and industrial property value share ($PCIV_{it}$), the log of population density (Ln_POPD_{it-1}), the log of unemployment rate (Ln_UER_{it-1}), the dummy for direct democracy institution of municipalities (DD_{it}), and two dummies for the form of municipal government ($FMG1_{it}$ and $FMG2_{it}$) have no statistically significant effects on the property value.

One of the important regression results found in Table 5-4 is the estimated coefficients on the log of municipal expenditures (Ln_TMB_{it-1}) and the log of school district expenditures (LN_TSB_{it-1}). The empirical results show that both coefficients are consistently significant and positive across four definitions of a public market, indicating that an increase in the level of either of these public goods has a positive effect on the total equalized property value.

According to the Brueckner's (1979, 1982) thesis, significant positive coefficients on expenditures indicate that public goods are not systematically overprovided, while significantly negative coefficients indicate that the public goods are not systematically underprovided. Therefore, the results provide evidence that public service provided by municipalities and education services are not being systematically overprovided and may indeed be underprovided in New Jersey.

Table 5-4. Results of Hedonic Property Value Model by OLS (2004)

Dependent Variable: Ln_TPV_{it}	Public Market			
	PM1	PM2	PM3	PM4
Ln_COM_{it}	0.109 (0.058)*	0.009 (0.058)	0.041 (0.043)	0.085 (0.033)**
Ln_MS_{it}	-0.044 (0.050)	0.023 (0.053)	-0.016 (0.035)	-0.044 (0.033)
$CONSOL_{it}$	-0.006 (0.037)	-0.012 (0.038)	-0.009 (0.037)	-0.004 (0.037)
$INTRA_{it}$	0.156 (0.078)**	0.167 (0.080)**	0.164 (0.079)**	0.145 (0.080)*
Ln_TMB_{it-1}	0.795 (0.063)***	0.783 (0.064)***	0.781 (0.061)***	0.785 (0.060)***
Ln_TSB_{it-1}	0.070 (0.024)***	0.066 (0.022)***	0.068 (0.023)***	0.071 (0.024)***
Ln_MSSA_{it-1}	-0.175 (0.028)***	-0.200 (0.029)***	-0.188 (0.027)***	-0.172 (0.026)***
Ln_HOS_{it}	0.344 (0.053)***	0.322 (0.051)***	0.342 (0.051)***	0.351 (0.054)***
Ln_PCIV_{it}	-0.015 (0.019)	-0.019 (0.018)	-0.017 (0.019)	-0.016 (0.019)
Ln_MNR_{it-4}	-0.020 (0.144)	-0.016 (0.143)	-0.010 (0.155)	-0.031 (0.148)
Ln_HB70_{it-4}	-0.120 (0.040)***	-0.122 (0.041)***	-0.126 (0.041)***	-0.114 (0.041)***
$POPG_{it-1}$	-0.022 (0.006)***	-0.024 (0.006)***	-0.024 (0.006)***	-0.024 (0.006)***
Ln_POPD_{it-1}	-0.011 (0.020)	-0.025 (0.020)	-0.024 (0.024)	-0.022 (0.020)
Ln_INC_{it-1}	0.401 (0.069)***	0.390 (0.071)***	0.390 (0.073)***	0.401 (0.070)***
Ln_POV_{it-1}	-0.150 (0.034)***	-0.148 (0.033)***	-0.147 (0.034)***	-0.149 (0.034)***
Ln_RBP_{it-1}	0.046 (0.010)***	0.045 (0.010)***	0.047 (0.010)***	0.048 (0.010)***
Ln_UER_{it-1}	-0.018 (0.033)	-0.019 (0.034)	-0.014 (0.034)	-0.022 (0.034)
Ln_CRI_{it-4}	0.034 (0.031)	0.041 (0.032)	0.037 (0.030)	0.041 (0.029)
DD_{it}	-0.042 (0.032)	-0.044 (0.032)	-0.043 (0.032)	-0.039 (0.032)
$FMG1_{it}$	-0.027 (0.035)	-0.036 (0.036)	-0.033 (0.035)	-0.025 (0.036)
$FMG2_{it}$	-0.007 (0.046)	-0.010 (0.046)	-0.010 (0.046)	0.002 (0.044)
Constant	3.894 (0.324)***	4.374 (0.397)***	4.074 (0.315)***	3.762 (0.372)***
Heteroskedasticity	128.6 (0.000)	126.2 (0.000)	131.5 (0.000)	133.9 (0.000)
N of Observation	566	566	566	566
R^2	0.960	0.960	0.960	0.961

Notes: 1. *, **, and *** denote statistical significance at the 0.10, 0.05, and 0.01 levels, respectively. 2. Standard errors robust to heteroskedasticity are in parenthesis. 3. Homoskedasticity assumption is tested by Breusch-Pagan test and p-values are in parenthesis.

5-4. Effect of Competition on Technical Efficiency

This section provides the Tobit regression results of the technical efficiency model examining the effects of inter-jurisdictional competition (Hypothesis 6) and school district consolidation (Hypothesis 10) on the technical efficiency of local governments. This study uses a two-stage approach. In the first stage, data envelopment analysis (DEA) is used to calculate pure technical efficiency scores of 566 New Jersey communities from 2001 to 2004. In the second stage, the technical efficiency scores are regressed on the degree of inter-jurisdictional competition (COM_{it}), a dummy for school district consolidation (*CONSOLi*) and other factors which are assumed to have effects on technical efficiency. The results provide strong evidence of Hypothesis 6 but no evidence of Hypothesis 10.

5-4-1. DEA Technical Efficiency Score

We use the software package FEAR 1.11 of Wilson (2007) in order to carry out the DEA estimations. In FEAR, efficiency is measured in terms of Shephard's (1970) input distance function, which is the reciprocal of Farrell's (1957) measure. The Shephard's measure takes on values of unity or larger. For the convenience of interpretation, we transform the Shepard's input distance efficiency estimates into Farell's input efficiency measures, which lie between zero and unity.

As a result of cross-sectional VRS, DEA calculations with annual data for 2001-2004, pure technical efficiency scores for each community in each year are obtained. In each year, fully efficient communities get an efficiency score equal to unity and inefficient ones get an efficiency score below unity. The number of technically efficient communities and summary statistics for the pure technical efficiency score are reported in Table 5-5. The average pure technical efficiency score (TE_{it}) is about 0.579 during the four years, indicating that the average loss of productivity due to technical inefficiency is 42.1%.

Table 5-5. Summary Statistics for the DEA Technical Efficiency Score (2001-2004)

	N of Efficient Municipality	Mean	Std. Dev.	Minimum	Maximum
2001	52	0.588	0.219	0.211	1
2002	44	0.527	0.233	0.160	1
2003	43	0.597	0.223	0.183	1
2004	43	0.602	0.222	0.187	1

5-4-2. Tobit Regression Analysis

The technical efficiency model is estimated by a Tobit censored random effects method, considering the distribution of the DEA pure technical efficiency score. The regression results are summarized in Table 5-6. The Breusch-Pagan Lagrangian Multiplier (LM) test for random-effects indicates that under all definitions of public markets the random-effects model performs better than the pooled Tobit model. The Wald x^2 rejects the null hypothesis that all coefficients are jointly zero at the .001 significance level.

A. Effect of Inter-jurisdictional Competition

We find strong evidence supporting the beneficial views of Tiebout, the Leviathan hypothesis, and yardstick competition that inter-jurisdictional competition enhances technical efficiency of local governments by reducing government waste or government rent-seeking behavior (Hypothesis 6). The coefficient on the log of the degree of inter-jurisdictional competition (*COM_{it}*) is positive and statistically significant in all four definitions of a public market. The coefficient indicates that a 10% increase in the number of municipalities in a public market per 1000 persons leads to 0.091 – 0.014 increase in pure technical efficiency score.

B. Effect of School District Consolidation

The statistical results of the technical efficiency model provide little evidence of a systematic difference in technical efficiency between communities which are member of a consolidated school district and communities with the regular school district. The coefficient on communities which are members of a consolidated school district ($CONSOL_i$) is negative, supporting the beneficial views of inter-jurisdictional competition. However, the coefficient is statistically significant only when the public market is defined by the second-order contiguity criterion. Therefore, we cannot tell which theoretical perspective is correct from these results.

C. Control Variables

The results in Table 5-6 show that the coefficients of control variables are consistent across the four definitions of a public market in terms of their magnitude, sign, and statistical significance. One exception is the dummy variable for the elected governing body and chief executive form of municipal government ($FMG1_{it}$) but its coefficient is insignificant under all definitions of public market. With the exception of personal income (INC_{it-1}), all other control variables yield the expected effects on technical efficiency.

The coefficient on personal income shows an unexpected positive effect on technical efficiency. Furthermore, it is statistically significant across all definitions of a public market. This may reflect some aspects of the local public service provision which require a significant investment of resources. For instance, the adoption of up to date techniques may be limited by the wealth of the communities. In addition, rich people may be more effective in demanding greater efficiency.

Both the percent of state aid in the municipal budget ($RMSA_{it}$) and the percent of state aid in rgw school district budget ($RSSA_{it}$) yield negative and statistically significant coefficients. This may imply that state aid not only encourage local service provisions but also leads to some technical inefficiency. While population (POP_{it}) and population density ($POPD_{it}$) have positive and statistically significant effect, the squared population ($POPS_{it}$) is negatively associated with the DEA technical efficiency score. This implies that there are economies of scale in providing local public goods but its effect is decreasing.

The results of Tobit regression show that while the percent of population with a BA or higher (PBA_i) and the percent of seniors ($P65_i$) have consistent positive effects, the log of market share (MS_{it}), the log of poverty rate (Ln_POV_{it}) and the percent of resident pupils (PSD_{it}) have consistent negative effects on technical efficiency. On the other hand, the dummy for the direct democracy institutions of municipalities (DD_{it}), and dummies for the form of municipal government ($FMG1_{it}$ and $FMG2_{it}$) are not statistically significant under all definitions of a public market.

Among the political institutional structures in which local governments operate, only the legal type of school districts influences the degree of technical efficiency. The coefficient of the dummy variable for communities with the Type II school district ($INTRA_i$) is positive and statistically significant under the first-order contiguity and the second-order contiguity but not the others. This provides some evidence that the budget referendum induces local governments to behave in a technically efficient way.

Table 5-6. Results of Technical Efficiency Model by Tobit Random-Effects (2001-2004)

Dependent Variable: TE_{it}	Public Market			
	PM1	PM2	PM3	PM4
Ln_COM_{it}	0.099 (0.012)***	0.097 (0.018)***	0.091 (0.018)***	0.139 (0.016)***
$CONSOL_{i}$	-0.034 (0.023)	-0.039 (0.023)*	-0.022 (0.023)	-0.033 (0.021)
Ln_MS_{it}	-0.102 (0.012)***	-0.087 (0.011)***	-0.074 (0.009)***	-0.119 (0.009)***
$RMSA_{it}$	-0.002 (0.001)**	-0.002 (0.001)**	-0.002 (0.001)*	-0.002 (0.001)**
$RSSA_{it}$	-9.4e-4 (4.78e-4)*	-9.3e-4 (4.8e-4)*	-5.4e-4 (4.9e-4)	-7.8e-4 (4.5e-4)*
POP_{it}	0.005 (0.001)***	0.005 (0.001)***	0.005 (0.001)***	0.009 (0.001)***
$POPS_{it}$	-9.1e-6 (4.0e-6)**	-7.3e-6 (4.1e-6)*	-8.0e-6 (4.1e-6)*	-2.0e-5 (3.7e-6)***
$POPD_{it}$	0.015 (0.002)***	0.015 (0.002)***	0.008 (0.002)***	0.013 (0.002)***
INC_{it-1}	5.6e-4 (2.7e-4)**	6.7e-4 (2.7e-4)**	6.3e-4 (2.7e-4)**	5.7e-4 (2.7e-4)**
Ln_POV_{it}	-0.025 (0.006)***	-0.026 (0.006)***	-0.027 (0.006)***	-0.027 (0.006)***
PSD_{it}	-0.006 (0.002)***	-0.006 (0.002)***	-0.006 (0.002)***	-0.006 (0.001)***
PBA_{i}	0.005 (0.001)***	0.005 (0.001)***	0.005 (0.001)***	0.005 (0.001)***
$P65_{i}$	0.006 (0.001)***	0.007 (0.001)***	0.006 (0.001)***	0.005 (0.001)***
DD_{it}	-0.019 (0.017)	-0.017 (0.018)	-0.010 (0.018)	-0.011 (0.016)
$INTRA_{it}$	0.080 (0.040)**	0.092 (0.041)**	0.052 (0.039)	0.058 (0.036)
$FMG1_{it}$	0.007 (0.023)	0.002 (0.023)	0.001 (0.023)	-0.003 (0.022)
$FMG2_{it}$	-0.030 (0.026)	-0.020 (0.027)	0.015 (0.027)	0.005 (0.024)
Year 2002	-0.071 (0.004)***	-0.072 (0.004)***	-0.071 (0.004)***	-0.071 (0.004)***
Year 2003	0.004 (0.004)	0.004 (0.004)	0.005 (0.004)	0.004 (0.004)
Year 2004	0.006 (0.004)	0.005 (0.004)	0.006 (0.004)	0.006 (0.004)
Constant	0.360 (0.072)***	0.282 (0.082)***	0.356 (0.080)***	0.197 (0.078)**
Rho	0.892 (0.007)	0.894 (0.007)	0.893 (0.007)	0.872 (0.008)
LM Test	2823.3 (0.000)	2850.6 (0.000)	2841.5 (0.000)	2562.8 (0.000)
N of Observation	2264	2264	2264	2264
N of Right Censored	182	182	182	182
Wald x^2	1125.6 (0.000)	1079.2 (0.000)	1116.1 (0.000)	1322.5 (0.000)
Log Likelihood	1897.3	1889.9	1893.4	1946.6

Notes: 1. *, **, and *** denote statistical significance at the 0.10, 0.05, and 0.01 levels, respectively. 2. Standard errors are in parenthesis. 3. For Wald x^2, p-values are in parenthesis. 4. Breusch-Pagan Lagrangian Multiplier (LM) test for random-effects.

Chapter VI. Conclusion

The main purpose of this study is to explore whether local governments engage in tax competition and what is the effect of competition on government performance. For this purpose we derive 12 hypotheses which are applicable to local governments in New Jersey. The hypotheses are tested by estimating several regression models. The results of regression analysis provide strong empirical evidence that local governments engage in tax competition and competition has significant effects on government performance. In this final chapter, the results of the analysis are summarized and discussed collectively to draw general conclusions and future research directions are recommended.

6-1. Summary of Empirical Findings

6-1-1. Existence of Competition

To investigate the presence of both inter- and intra-jurisdictional competition, we used a 2004 cross-sectional data set of 566 municipalities in New Jersey and estimated municipal tax rate models using spatial econometric techniques. The results of both the spatial lag model estimated by IV estimation and the spatial error model estimated by GMM confirm the existence of intra-jurisdictional competition in setting property tax rates between municipalities and school districts, and between municipalities and counties. The results indicate that municipalities respond to an increase in school district tax rates by increasing their tax rates. On the other hand, municipalities react to changes in the tax rate of a county by lowering their tax rates.

The spatial regression analyses also provide strong evidence of inter-jurisdictional competition among municipalities, showing that the coefficient of the spatially lagged dependent variable is positive and statistically significant in three weight matrices defined by first-order contiguity, second-order contiguity, and Euclidean distance. The positive coefficient on the average tax rates of competing jurisdictions indicates that municipalities engage in property tax competition. In addition, under the county boundary-based weight matrix, we also find evidence of inter-municipal competition, showing that both the spatial error and the spatial lag coefficients are statistically significant.

6-1-2. Effect of Competition on Government Performance

To examine the effect of inter- and intra-jurisdictional competition on government performance, we estimate several regression models relating government performance to measures of inter- and intra-jurisdictional competition. We measure government performance in terms of the combined municipal-school district property tax rates, property values as a proxy for allocative efficiency, and pure technical efficiency calculated by the DEA.

A. Inter-jurisdictional Competition

The degree of inter-jurisdictional competition is measured by the number of municipal governments within a public market, and the structure of public market is calculated as the share of population to the total population of the public market. The regression results show that inter-jurisdictional competition leads to lower combined municipal-school district tax rates, allocative efficiency, and technical efficiency. This is consistent with Tiebout, the Leviathan hypothesis, and the yardstick competition literatures' optimistic views on inter-jurisdictional competition.

B. Intra-jurisdictional Competition vs. Budget Referendum

The effect of intra-jurisdictional competition is tested by examining a systematic difference in government performance between communities with the Type I school district and communities with the Type II school district. However, the dummy variable also reflects difference in direct democracy institutions between the Type I and the Type II school district. The results provide strong evidence that budget referendum effect dominates the intra-jurisdictional competition effect, showing that the property tax rates are lower, and both total equalized property values and the DEA pure technical efficiency score are higher in communities with the Type II school district.

C. School District Consolidation

The variations in types of school districts in New Jersey give us an opportunity to examine the contrasting theoretical predictions about the consequence of local government consolidation. We compare the combined municipal-school district tax rates, total equalized property values, and the DEA pure technical efficiency score between communities which are members of a consolidated school district and communities with the regular school district using regression techniques. The results shows that school district consolidation leads to lower tax rates but does not have any significant impact on allocative efficiency and technical efficiency.

6-2. Contribution to the Existing Literature

This study contributes to the understanding of fiscal competition among local governments by empirically examining this relatively ignored or untouched issue. First, this study improves previous empirical studies by investigating the consequences of competition in terms of efficiency. Theoretical analyses of competition among governments have exclusively explored the consequences of competition in terms of efficiency. However, empirical studies have focused on the effect of inter-jurisdictional competition on the government size which is measured by the level of expenditures and revenues. All theories of inter-jurisdictional competition have a common prediction that competition lowers the tax rate and the government budget size, but they have different views on the efficiency implication of competition. Therefore, empirical studies of the government size cannot answer which theoretical perspective is correct.

Second, this study extends the existing literature on government competition by simultaneously examining the presence and the consequences of competition. The empirical literature on inter-jurisdictional competition can be categorized into two strands: studies on the existence of competition and studies on its effects. No study has dealt with these two issues at the same time. The former did not extend their studies to the effect of competition, and the latter did not examine formally the existence of competition, either appealing to a theory of tax competition or presuming such competition exists rather than empirically examining the existence of competition.

Third, by examining the inter-municipal tax competition, this study also contributes to the understanding of inter-jurisdictional competition at the local municipal level in the U.S. context. While many empirical studies have provided evidence for the presence of inter-state tax competition, only two studies empirically examined inter-municipal tax competition. Unlikely other studies dealing with hierarchical intra-jurisdictional competition, this study investigates intra-jurisdictional tax competition between municipalities and school districts which have co-equal powers, share the same jurisdiction, and co-occupy the same tax base.

6-3. Limitations and Recommendations for Future Researches

There are some limitations in the way this study is done. Along with a discussion of its limitations, are suggestions for correcting these limitations to be addressed in future searches.

There are various approaches in measuring technical efficiency. However, this study measures technical efficiency by using only the DEA approach. Literature shows that there is no statistically significant correlation between technical efficiency scores calculated by different techniques. If we measure technical efficiency by other techniques such as SFA, DFA, and COLS, we may come to different conclusions. Therefore, to get more robust results, it may be advisable to use multiple methods of measuring technical efficiency and, then, compare the stability/fragility of the results.

Even though this study reveals that inter-jurisdictional competition exists among municipalities in the property tax rate setting, it cannot be said whether it is induced by citizens' mobility (exit) or by citizens' comparative performance evaluation (voice). This is because the significant spatial autocorrelation in property tax rates among municipalities can be can be explained by either the mobility-based tax competition theory or the information-based yardstick competition theory. This issue can be investigated by linking spatial autocorrelation to political processes or by relating it to the tax base.

Governments compete for scarce benefit resources through various policy tools. For example, inter-jurisdictional competition can occur via regulation, welfare, expenditures, and other policy areas. However, this study examines inter-municipal competition in setting property tax rates. To understand fiscal competition among governments comprehensively, it is required to investigate inter-jurisdictional competition in such government policy areas.

Appendices

Appendix A. First-Stage Regression Outputs of Non-Spatial Model

A-1. School District Tax Rate (STR_t)

First-stage regression of STR_t:

Source	SS	df	MS
Model	151.944779	23	6.60629475
Residual	16.8334476	542	.031058021
Total	168.778227	565	.298722525

Number of obs =	566
F(23, 542) =	212.71
Prob > F =	0.0000
R-squared =	0.9003
Adj R-squared =	0.8960
Root MSE =	.17623

STR_t	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
$PMTL_{t-1}$	.0033194	.0048452	0.69	0.494	-.0061982	.012837
$PMSA_{t-1}$	.0082509	.0357738	0.23	0.818	-.0620214	.0785231
POP_{t-1}	-.0005404	.0007584	-0.71	0.476	-.00203	.0009493
$POPS_{t-1}$	2.52e-06	3.65e-06	0.69	0.490	-4.64e-06	9.68e-06
$POPD_{t-1}$	-1.07e-06	2.09e-06	-0.51	0.608	-5.18e-06	3.03e-06
$P65_{t-4}$	.0008339	.0015552	0.54	0.592	-.002221	.0038888
PBA_{t-4}	-.0029994	.0008665	-3.46	0.001	-.0047015	-.0012974
PHO_{t-4}	.0004436	.0006691	0.66	0.508	-.0008707	.0017579
RBP_{t-1}	-.0000305	.0000821	-0.37	0.711	-.0001918	.0001308
UER_{t-1}	-.0064241	.0045536	-1.41	0.159	-.0153689	.0025208
INC_{t-1}	.0044529	.0005878	7.58	0.000	.0032983	.0056075
POV_{t-1}	.0017888	.0023753	0.75	0.452	-.002877	.0064547
CRI_{t-4}	.0005054	.0004448	1.14	0.256	-.0003684	.0013793
PAA_{t-4}	.0001802	.0008398	0.21	0.830	-.0014694	.0018298
DD_t	.041479	.020356	2.04	0.042	.0014927	.0814652
$FMG1_t$	.0183574	.0276584	0.66	0.507	-.0359734	.0726883
$FMG2_t$	.0377999	.0303835	1.24	0.214	-.0218839	.0974837
$CONSOL_t$	.0156211	.0237219	0.66	0.510	-.030977	.0622191
$INTRA_t$	-.2364323	.0440201	-5.37	0.000	-.3229033	-.1499613
STR_{t-1}	1.067804	.0185501	57.56	0.000	1.031366	1.104243
$PCTL_{t-1}$	-.008114	.0110089	-0.74	0.461	-.0297394	.0135114
$POPC_{t-1}$	1.79e-09	3.72e-08	0.05	0.962	-7.12e-08	7.48e-08
$INCC_{t-1}$	9.94e-07	1.07e-06	0.93	0.355	-1.11e-06	3.10e-06
_cons	-.0800924	.1026087	-0.78	0.435	-.2816518	.121467

A-2. County Tax Rate (CTR_t)

First-stage regression of CTRt:

Source	SS	df	MS
Model	13.8791976	23	.603443375
Residual	7.50324645	542	.013843628
Total	21.3824441	565	.037845034

Number of obs	566
F(23, 542)	43.59
Prob > F	0.0000
R-squared	0.6491
Adj R-squared	0.6342
Root MSE	.11766

CTR_t	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
$PMTL_{t-1}$	-.0092185	.0032348	-2.85	0.005	-.0155728	-.0028642
$PMSA_{t-1}$	.0564047	.0238838	2.36	0.019	.0094886	.1033208
POP_{t-1}	.0004629	.0005063	0.91	0.361	-.0005317	.0014574
$POPS_{t-1}$	-5.13e-07	2.43e-06	-0.21	0.833	-5.29e-06	4.27e-06
$POPD_{t-1}$	3.37e-06	1.39e-06	2.42	0.016	6.29e-07	6.11e-06
$P65_{t-4}$	-.0016311	.0010383	-1.57	0.117	-.0036706	.0004085
PBA_{t-4}	-.0009112	.0005785	-1.58	0.116	-.0020476	.0002251
PHO_{t-4}	.0001153	.0004467	0.26	0.796	-.0007622	.0009928
RBP_{t-1}	-.0001153	.0000548	-2.10	0.036	-.000223	-7.60e-06
UER_{t-1}	-.0173479	.0030401	-5.71	0.000	-.0233198	-.011376
INC_{t-1}	.0009363	.0003924	2.39	0.017	.0001655	.0017072
POV_{t-1}	.0078174	.0015858	4.93	0.000	.0047023	.0109325
CRI_{t-4}	-.0007157	.000297	-2.41	0.016	-.0012991	-.0001323
PAA_{t-4}	.0018431	.0005607	3.29	0.001	.0007418	.0029445
DD_t	-.0048535	.0135903	-0.36	0.721	-.0315497	.0218427
$FMG1_t$	.0369584	.0184657	2.00	0.046	.0006853	.0732315
$FMG2_t$	.0482739	.020285	2.38	0.018	.008427	.0881208
$CONSOL_t$	-.0146184	.0158375	-0.92	0.356	-.0457288	.0164921
$INTRA_t$	.0464804	.0293893	1.58	0.114	-.0112506	.1042113
STR_{t-1}	.0769149	.0123847	6.21	0.000	.052587	.1012427
$PCTL_{t-1}$	.0180505	.0073499	2.46	0.014	.0036127	.0324883
$POPC_{t-1}$	-2.68e-07	2.48e-08	-10.80	0.000	-3.17e-07	-2.19e-07
$INCC_{t-1}$	-.0000109	7.17e-07	-15.14	0.000	-.0000123	-9.45e-06
_cons	.8778248	.068505	12.81	0.000	.743257	1.012393

Appendix B. First-Stage Regression Outputs of Spatial Lag Model by 2SLS

B-1. First Order Contiguity Weights

First-stage regression of MTR_{t}_W1:

OLS estimation

Estimates efficient for homoskedasticity only

Statistics robust to heteroskedasticity

		Number of obs =	566
		F(33, 532) =	70.01
		Prob > F =	0.0000
Total (centered) SS =	33.79644092	Centered R2 =	0.7214
Total (uncentered) SS =	163.2530117	Uncentered R2 =	0.9423
Residual SS =	9.414012783	Root MSE =	.133

MTR_{t}_W1	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
$PMTL_{t-1}$	.005111	.0033965	1.50	0.133	-.0015611	.0117831
$PMSA_{t-1}$	-.0248261	.0250995	-0.99	0.323	-.0741325	.0244802
POP_{t-1}	.0007314	.0006142	1.19	0.234	-.0004751	.001938
$POPS_{t-1}$	-6.72e-08	2.85e-06	-0.02	0.981	-5.66e-06	5.53e-06
$POPD_{t-1}$	.0015951	.0031702	0.50	0.615	-.0046327	.0078228
INC_{t-1}	.0005659	.0003546	1.60	0.111	-.0001308	.0012626
POV_{t-1}	.0001784	.002507	0.07	0.943	-.0047465	.0051032
RBP_{t-1}	-.0000966	.0000467	-2.07	0.039	-.0001884	-4.84e-06
UER_{t-1}	-.0123824	.0040271	-3.07	0.002	-.0202934	-.0044714
$P65_{t-4}$	.0006544	.0011625	0.56	0.574	-.0016294	.0029381
PBA_{t-4}	-.0021843	.000635	-3.44	0.001	-.0034317	-.0009369
PAA_{t-4}	.0009165	.0009129	1.00	0.316	-.0008768	.0027098
PHO_{t-4}	.0013271	.0005415	2.45	0.015	.0002633	.0023909
CRI_{t-4}	.0010501	.0003578	2.93	0.003	.0003472	.0017529
DD_{t}	-.0046718	.0184091	-0.25	0.800	-.0408353	.0314917
$CONSOL_{t}$	-.0150622	.0139395	-1.08	0.280	-.0424453	.0123209
$INTRA_{t}$	.0348148	.0331756	1.05	0.294	-.0303564	.099986
$FMG1_{t}$	.0037618	.0189169	0.20	0.842	-.0333992	.0409229
$FMG2_{t}$	-.0384717	.0246285	-1.56	0.119	-.0868528	.0099094
$PMTL_{t-1}$_W1	.0027208	.0024115	1.13	0.260	-.0020164	.0074581
POP_{t-1}_W1	.0017851	.0007519	2.37	0.018	.0003081	.0032621
$POPS_{t-1}$_W1	-.0000112	3.79e-06	-2.95	0.003	-.0000186	-3.73e-06
$POPD_{t-1}$_W1	.0169108	.006888	2.46	0.014	.0033798	.0304418
POV_{t-1}_W1	.0244638	.0046731	5.23	0.000	.0152837	.0336439
RBP_{t-1}_W1	-.0002202	.000091	-2.42	0.016	-.0003989	-.0000416
$P65_{t-4}$_W1	-.0017753	.0017128	-1.04	0.300	-.00514	.0015893
PAA_{t-4}_W1	.0023087	.0017963	1.29	0.199	-.00122	.0058374
PHO_{t-4}_W1	-.0033845	.0013761	-2.46	0.014	-.0060878	-.0006812
CRI_{t-4}_W1	.0024962	.0006291	3.97	0.000	.0012603	.0037321
STR_{t-1}	.0789267	.0271405	2.91	0.004	.025611	.1322423
$PCTL_{t-1}$	-.0001413	.0088048	-0.02	0.987	-.0174377	.0171551
$POPC_{t-1}$	.0001492	.0000305	4.90	0.000	.0000894	.0002091
$INCC_{t-1}$	.0017457	.0007237	2.41	0.016	.000324	.0031674
_cons	.2568097	.1341484	1.91	0.056	-.0067159	.5203352

Included instruments: $PMTL_{t-1}$ $PMSA_{t-1}$ POP_{t-1} $POPS_{t-1}$ $POPD_{t-1}$ INC_{t-1} POV_{t-1} RBP_{t-1} UER_{t-1} P65 PBA PAA PHO CRI DD CONSOL COORDI FMG1 FMG2 $PMTL_{t-1}$_W1 POP_{t-1}_W1 $POPS_{t-1}$_W1 $POPD_{t-1}$_W1 POV_{t-1}_W1 RBP_{t-1}_W1 P65_W1 PAA_W1 PHO_W1 CRI_W1 STR_{t-1} $PCTL_{t-1}$ $POPC_{t-1}$ $INCC_{t-1}$

Partial R-squared of excluded instruments: 0.5684

Test of excluded instruments:

F(14, 532) = 53.83

Prob > F = 0.0000

First-stage regression of STR_t:

OLS estimation

Estimates efficient for homoskedasticity only
Statistics robust to heteroskedasticity

		Number of obs =	566
		F(33, 532) =	230.81
		Prob > F =	0.0000
Total (centered) SS =	168.7782268	Centered R2 =	0.9050
Total (uncentered) SS =	990.6832035	Uncentered R2 =	0.9838
Residual SS =	16.03158899	Root MSE =	.1736

STR_t	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
$PMTL_{t-1}$	.002843	.0057138	0.50	0.619	-.0083815	.0140675
$PMSA_{t-1}$	.0065882	.0304132	0.22	0.829	-.0531565	.0663329
POP_{t-1}	-.0003008	.0005561	-0.54	0.589	-.0013931	.0007916
$POPS_{t-1}$	1.03e-06	2.53e-06	0.41	0.683	-3.94e-06	6.01e-06
$POPD_{t-1}$	-.0044264	.0033481	-1.32	0.187	-.0110034	.0021507
INC_{t-1}	.0042603	.0030105	1.42	0.158	-.0016536	.0101743
POV_{t-1}	.0024537	.0022329	1.10	0.272	-.0019327	.0068401
RBP_{t-1}	-2.61e-06	.0000413	-0.06	0.950	-.0000837	.0000785
UER_{t-1}	-.0042301	.005403	-0.78	0.434	-.014844	.0063838
$P65_{t-4}$	.0005078	.001999	0.25	0.800	-.003419	.0044346
PBA_{t-4}	-.0029294	.0030688	-0.95	0.340	-.008958	.0030991
PAA_{t-4}	-.000855	.0010363	-0.83	0.410	-.0028909	.0011808
PHO_{t-4}	.0003108	.0006873	0.45	0.651	-.0010394	.0016609
CRI_{t-4}	.0002937	.0004054	0.72	0.469	-.0005027	.00109
DD_t	.0374115	.0372905	1.00	0.316	-.0358432	.1106661
$CONSOL_t$	.018476	.0139404	1.33	0.186	-.0089091	.045861
$INTRA_t$	-.262779	.1778689	-1.48	0.140	-.6121906	.0866326
$FMG1_t$	.0218924	.0173265	1.26	0.207	-.0121443	.0559291
$FMG2_t$	.0323977	.0268678	1.21	0.228	-.0203823	.0851778
$PMTL_{t-1}$_W1	.0027572	.001614	1.71	0.088	-.0004134	.0059278
POP_{t-1}_W1	.0002332	.000825	0.28	0.778	-.0013875	.001854
$POPS_{t-1}$_W1	-5.49e-06	4.64e-06	-1.18	0.237	-.0000146	3.62e-06
$POPD_{t-1}$_W1	.0085499	.0053099	1.61	0.108	-.0018811	.0189809
POV_{t-1}_W1	-.0023869	.0075229	-0.32	0.751	-.0171652	.0123913
RBP_{t-1}_W1	-.0000913	.0001195	-0.76	0.445	-.000326	.0001433
$P65_{t-4}$_W1	.0048016	.0042748	1.12	0.262	-.003596	.0131991
PAA_{t-4}_W1	.0057353	.0049709	1.15	0.249	-.0040297	.0155002
PHO_{t-4}_W1	.0001209	.0008587	0.14	0.888	-.001566	.0018077
CRI_{t-4}_W1	-.0012692	.0008143	-1.56	0.120	-.0028687	.0003304
STR_{t-1}	1.060595	.033257	31.89	0.000	.9952639	1.125926
$PCTL_{t-1}$	-.0054257	.0144163	-0.38	0.707	-.0337456	.0228943
$POPC_{t-1}$	-.0000589	.0000308	-1.91	0.056	-.0001194	1.55e-06
$INCC_{t-1}$	.0017099	.0007773	2.20	0.028	.0001831	.0032368
_cons	-.1184549	.1905237	-0.62	0.534	-.492726	.2558162

Included instruments: $PMTL_{t-1}$ $PMSA_{t-1}$ POP_{t-1} $POPS_{t-1}$ $POPD_{t-1}$ INC_{t-1} POV_{t-1} RBP_{t-1} UER_{t-1} P65 PBA PAA PHO CRI DD CONSOL COORDI FMG1 FMG2 $PMTL_{t-1}$_W1 POP_{t-1}_W1 $POPS_{t-1}$_W1 $POPD_{t-1}$_W1 POV_{t-1}_W1 RBP_{t-1}_W1 P65_W1 PAA_W1 PHO_W1 CRI_W1 STR_{t-1} $PCTL_{t-1}$ $POPC_{t-1}$ $INCC_{t-1}$

Partial R-squared of excluded instruments: 0.8708
Test of excluded instruments:
F(14, 532) = 123.14
Prob > F = 0.0000

First-stage regression of CTR$_t$:

OLS estimation

Estimates efficient for homoskedasticity only
Statistics robust to heteroskedasticity

		Number of obs =	566
		F(33, 532) =	55.30
		Prob > F =	0.0000
Total (centered) SS =	21.38244407	Centered R2 =	0.7279
Total (uncentered) SS =	124.4604994	Uncentered R2 =	0.9532
Residual SS =	5.81892598	Root MSE =	.1046

CTR$_t$	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
PMTL$_{t-1}$	-.0076074	.0031858	-2.39	0.017	-.0138657	-.0013492
PMSA$_{t-1}$	.0392653	.0223669	1.76	0.080	-.0046729	.0832035
POP$_{t-1}$	.0006966	.0003883	1.79	0.073	-.0000663	.0014595
POPS$_{t-1}$	-2.20e-06	1.69e-06	-1.30	0.193	-5.51e-06	1.11e-06
POPD$_{t-1}$	.0009984	.0011008	0.91	0.365	-.001164	.0031608
INC$_{t-1}$	.0006005	.0003204	1.87	0.061	-.000029	.00123
POV$_{t-1}$	.0062372	.0021408	2.91	0.004	.0020316	.0104427
RBP$_{t-1}$	-.0000699	.000043	-1.63	0.104	-.0001543	.0000145
UER$_{t-1}$	-.0117366	.0033416	-3.51	0.000	-.018301	-.0051721
P65$_{t-4}$	-.0001416	.0010592	-0.13	0.894	-.0022223	.0019391
PBA$_{t-4}$	-.0001524	.0005278	-0.29	0.773	-.0011892	.0008844
PAA$_{t-4}$	.0011377	.0007811	1.46	0.146	-.0003967	.0026722
PHO$_{t-4}$	.0000378	.0005717	0.07	0.947	-.0010852	.0011609
CRI$_{t-4}$	-.0004433	.0003864	-1.15	0.252	-.0012022	.0003157
DD$_t$	-.009674	.0115321	-0.84	0.402	-.0323281	.0129801
CONSOL$_t$	-.0107389	.0140514	-0.76	0.445	-.0383419	.0168641
INTRA$_t$	.0151906	.0258371	0.59	0.557	-.0355647	.0659458
FMG1$_t$	.0399406	.0154547	2.58	0.010	.0095809	.0703003
FMG2$_t$	.0321839	.0183117	1.76	0.079	-.0037882	.068156
PMTL$_{t-1}$_W1	-.0021622	.0011753	-1.84	0.066	-.004471	.0001465
POP$_{t-1}$_W1	-.0009095	.0005595	-1.63	0.105	-.0020086	.0001896
POPS$_{t-1}$_W1	1.11e-06	2.89e-06	0.39	0.700	-4.57e-06	6.79e-06
POPD$_{t-1}$_W1	.0010314	.0018581	0.56	0.579	-.0026186	.0046815
POV$_{t-1}$_W1	.0192929	.0043691	4.42	0.000	.0107101	.0278756
RBP$_{t-1}$_W1	-.0002431	.0000736	-3.31	0.001	-.0003876	-.0000986
P65$_{t-4}$_W1	-.0005918	.001099	-0.54	0.590	-.0027508	.0015672
PAA$_{t-4}$_W1	.0013526	.0013579	1.00	0.320	-.0013149	.00402
PHO$_{t-4}$_W1	-.0010818	.00081	-1.34	0.182	-.0026731	.0005094
CRI$_{t-4}$_W1	-.0033093	.0005451	-6.07	0.000	-.0043801	-.0022386
STR$_{t-1}$	.0692904	.0271578	2.55	0.011	.0159408	.12264
PCTL$_{t-1}$	.0180529	.008963	2.01	0.044	.0004458	.03566
POPC$_{t-1}$	-.0002652	.0000233	-11.40	0.000	-.0003109	-.0002195
INCC$_{t-1}$	-.0111715	.0005836	-19.14	0.000	-.012318	-.0100249
_cons	1.03874	.1137532	9.13	0.000	.8152798	1.262201

Included instruments: PMTL$_{t-1}$ PMSA$_{t-1}$ POP$_{t-1}$ POPS$_{t-1}$ POPD$_{t-1}$ INC$_{t-1}$ POV$_{t-1}$ RBP$_{t-1}$
UER$_{t-1}$ P65 PBA PAA PHO CRI DD CONSOL COORDI FMG1 FMG2
PMTL$_{t-1}$_W1 POP$_{t-1}$_W1 POPS$_{t-1}$_W1 POPD$_{t-1}$_W1 POV$_{t-1}$_W1 RBP$_{t-1}$_W1
P65_W1 PAA_W1 PHO_W1 CRI_W1 STR$_{t-1}$ PCTL$_{t-1}$ POPC$_{t-1}$ INCC$_{t-1}$

Partial R-squared of excluded instruments: 0.5953
Test of excluded instruments:
F(14, 532) = 68.62
Prob > F = 0.0000

B-2. Second Order Contiguity Weights

First-stage regression of MTR_t_W2:

```
OLS estimation
--------------
Estimates efficient for homoskedasticity only
Statistics robust to heteroskedasticity
                                                      Number of obs =      566
                                                      F( 33,   532) =    69.66
                                                      Prob > F      =   0.0000
Total (centered) SS     =  24.40258876                Centered R2   =   0.7364
Total (uncentered) SS   =  157.1858406                Uncentered R2 =   0.9591
Residual SS             =  6.432464979                Root MSE      =      .11
```

MTR_t_W2	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
$PMTL_{t-1}$	.0020679	.0023582	0.88	0.381	-.0025647	.0067005
$PMSA_{t-1}$	-.003363	.0179736	-0.19	0.852	-.0386709	.031945
POP_{t-1}	.0014242	.0005515	2.58	0.010	.0003409	.0025076
$POPS_{t-1}$	-4.99e-06	2.21e-06	-2.26	0.024	-9.33e-06	-6.47e-07
$POPD_{t-1}$	.0009598	.0015893	0.60	0.546	-.0021623	.0040818
INC_{t-1}	.0005363	.0002662	2.01	0.044	.0000133	.0010592
POV_{t-1}	-.0001805	.0021393	-0.08	0.933	-.0043829	.004022
RBP_{t-1}	-.0000279	.0000541	-0.52	0.606	-.0001343	.0000784
UER_{t-1}	-.0031593	.003082	-1.03	0.306	-.0092136	.002895
$P65_{t-4}$	.0000526	.0010492	0.05	0.960	-.0020085	.0021138
PBA_{t-4}	-.0003823	.0005106	-0.75	0.454	-.0013854	.0006207
PAA_{t-4}	.0001846	.0006508	0.28	0.777	-.0010939	.0014632
PHO_{t-4}	.0007207	.0003975	1.81	0.070	-.0000602	.0015016
CRI_{t-4}	.0005374	.0002085	2.58	0.010	.0001279	.0009469
DD_t	-.011399	.0143095	-0.80	0.426	-.039509	.016711
$CONSOL_t$	-.0182272	.0113973	-1.60	0.110	-.0406164	.0041619
$INTRA_t$	-.0526527	.0259885	-2.03	0.043	-.1037053	-.0016001
$FMG1_t$	.0135338	.0175875	0.77	0.442	-.0210156	.0480833
$FMG2_t$	-.0125221	.0209594	-0.60	0.550	-.0536955	.0286513
$PMTL_{t-1}$_W2	-.0011614	.0039892	-0.29	0.771	-.0089979	.006675
POP_{t-1}_W2	.0073957	.0013586	5.44	0.000	.0047268	.0100645
$POPS_{t-1}$_W2	-.000038	8.44e-06	-4.51	0.000	-.0000546	-.0000214
$POPD_{t-1}$_W2	.025185	.005046	4.99	0.000	.0152725	.0350975
POV_{t-1}_W2	.0366784	.0048018	7.64	0.000	.0272457	.0461112
RBP_{t-1}_W2	-.0007424	.000139	-5.34	0.000	-.0010155	-.0004694
$P65_{t-4}$_W2	-.0095355	.0029009	-3.29	0.001	-.0152342	-.0038367
PAA_{t-4}_W2	-.0238931	.0083688	-2.86	0.004	-.040333	-.0074532
PHO_{t-4}_W2	-.0018625	.001441	-1.29	0.197	-.0046932	.0009682
CRI_{t-4}_W2	.0040217	.0008824	4.56	0.000	.0022883	.0057552
STR_{t-1}	.0670488	.0206689	3.24	0.001	.0264461	.1076515
$PCTL_{t-1}$	-.0045571	.0072942	-0.62	0.532	-.0188861	.0097718
$POPC_{t-1}$	.0000708	.0000284	2.50	0.013	.0000151	.0001264
$INCC_{t-1}$	.0003777	.0006004	0.63	0.530	-.0008017	.0015571
_cons	.3070403	.1302701	2.36	0.019	.0511334	.5629473

Included instruments: $PMTL_{t-1}$ $PMSA_{t-1}$ POP_{t-1} $POPS_{t-1}$ $POPD_{t-1}$ INC_{t-1} POV_{t-1} RBP_{t-1} UER_{t-1} P65 PBA PAA PHO CRI DD CONSOL COORDI FMG1 FMG2 $PMTL_{t-1}$_W2 POP_{t-1}_W2 $POPS_{t-1}$_W2 $POPD_{t-1}$_W2 POV_{t-1}_W2 RBP_{t-1}_W2 P65_W2 PAA_W2 PHO_W2 CRI_W2 STR_{t-1} $PCTL_{t-1}$ $POPC_{t-1}$ $INCC_{t-1}$

```
Partial R-squared of excluded instruments:   0.6235
Test of excluded instruments:
  F( 14,   532) =    58.19
  Prob > F      =   0.0000
```

First-stage regression of STR_t:

OLS estimation

Estimates efficient for homoskedasticity only
Statistics robust to heteroskedasticity

			Number of obs =	566
			F(33, 532) =	414.48
			Prob > F =	0.0000
Total (centered) SS	=	168.7782268	Centered R2 =	0.9036
Total (uncentered) SS	=	990.6832035	Uncentered R2 =	0.9836
Residual SS	=	16.26775596	Root MSE =	.1749

STR_t	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
$PMTL_{t-1}$	.00109	.0053348	0.20	0.838	-.0093899	.0115699
$PMSA_{t-1}$	.011603	.0279062	0.42	0.678	-.0432169	.066423
POP_{t-1}	-.000344	.0006079	-0.57	0.572	-.0015382	.0008501
$POPS_{t-1}$	3.49e-07	2.79e-06	0.13	0.900	-5.13e-06	5.83e-06
$POPD_{t-1}$	-.0032543	.002957	-1.10	0.272	-.009063	.0025545
INC_{t-1}	.0044874	.0032994	1.36	0.174	-.001994	.0109688
POV_{t-1}	.0026594	.0020641	1.29	0.198	-.0013954	.0067143
RBP_{t-1}	-.0000262	.0000453	-0.58	0.563	-.0001152	.0000627
UER_{t-1}	-.0086409	.0081395	-1.06	0.289	-.0246304	.0073485
$P65_{t-4}$	-.0000555	.0021393	-0.03	0.979	-.004258	.004147
PBA_{t-4}	-.0033546	.0033027	-1.02	0.310	-.0098426	.0031334
PAA_{t-4}	.0002738	.0007284	0.38	0.707	-.0011572	.0017047
PHO_{t-4}	.000636	.0006519	0.98	0.330	-.0006447	.0019167
CRI_{t-4}	.0003111	.0003982	0.78	0.435	-.0004712	.0010933
DD_t	.0470051	.0442579	1.06	0.289	-.0399367	.1339469
$CONSOL_t$	.0239211	.0144445	1.66	0.098	-.0044542	.0522964
$INTRA_t$	-.242349	.1711032	-1.42	0.157	-.5784698	.0937718
$FMG1_t$	.0322649	.021727	1.49	0.138	-.0104165	.0749462
$FMG2_t$	.0461797	.0326924	1.41	0.158	-.0180424	.1104018
$PMTL_{t-1}$_W2	-.0012543	.0046844	-0.27	0.789	-.0104566	.0079479
POP_{t-1}_W2	-.0001571	.0011506	-0.14	0.891	-.0024175	.0021032
$POPS_{t-1}$_W2	-6.20e-06	8.70e-06	-0.71	0.477	-.0000233	.0000109
$POPD_{t-1}$_W2	.0163739	.0063293	2.59	0.010	.0039404	.0288073
POV_{t-1}_W2	-.0102206	.0074109	-1.38	0.168	-.0247788	.0043376
RBP_{t-1}_W2	-.0000732	.0001717	-0.43	0.670	-.0004106	.0002641
$P65_{t-4}$_W2	.0086015	.0066292	1.30	0.195	-.0044212	.0216242
PAA_{t-4}_W2	.0115221	.0101612	1.13	0.257	-.0084389	.031483
PHO_{t-4}_W2	7.57e-07	.0015994	0.00	1.000	-.0031411	.0031426
CRI_{t-4}_W2	-.0000691	.000831	-0.08	0.934	-.0017015	.0015632
STR_{t-1}	1.079154	.0408135	26.44	0.000	.9989783	1.159329
$PCTL_{t-1}$	-.0014508	.0143855	-0.10	0.920	-.0297102	.0268086
$POPC_{t-1}$	-.0000888	.0000389	-2.28	0.023	-.0001652	-.0000125
$INCC_{t-1}$	.0011848	.0008174	1.45	0.148	-.000421	.0027906
_cons	-.1795095	.2514506	-0.71	0.476	-.6734673	.3144484

Included instruments: $PMTL_{t-1}$ $PMSA_{t-1}$ POP_{t-1} $POPS_{t-1}$ $POPD_{t-1}$ INC_{t-1} POV_{t-1} RBP_{t-1}
UER_{t-1} P65 PBA PAA PHO CRI DD CONSOL COORDI FMG1 FMG2
$PMTL_{t-1}$_W2 POP_{t-1}_W2 $POPS_{t-1}$_W2 $POPD_{t-1}$_W2 POV_{t-1}_W2 RBP_{t-1}_W2
P65_W2 PAA_W2 PHO_W2 CRI_W2 STR_{t-1} $PCTL_{t-1}$ $POPC_{t-1}$ $INCC_{t-1}$

Partial R-squared of excluded instruments: 0.8689
Test of excluded instruments:
F(14, 532) = 192.89
Prob > F = 0.0000

First-stage regression of CTR_t:

OLS estimation

Estimates efficient for homoskedasticity only
Statistics robust to heteroskedasticity

		Number of obs =	566
		F(33, 532) =	72.37
		Prob > F =	0.0000
Total (centered) SS =	21.38244407	Centered R2 =	0.7426
Total (uncentered) SS =	124.4604994	Uncentered R2 =	0.9558
Residual SS =	5.503739793	Root MSE =	.1017

CTR_t	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
$PMTL_{t-1}$	-.0080985	.002693	-3.01	0.003	-.0133888	-.0028082
$PMSA_{t-1}$	.0296863	.0158682	1.87	0.062	-.0014857	.0608583
POP_{t-1}	.0001786	.0004025	0.44	0.657	-.000612	.0009692
$POPS_{t-1}$	-3.15e-07	1.94e-06	-0.16	0.871	-4.13e-06	3.50e-06
$POPD_{t-1}$	.0024256	.0008643	2.81	0.005	.0007277	.0041234
INC_{t-1}	.000364	.0004271	0.85	0.394	-.000475	.001203
POV_{t-1}	.0066034	.0021737	3.04	0.002	.0023333	.0108734
RBP_{t-1}	-.0000756	.0000476	-1.59	0.113	-.0001691	.000018
UER_{t-1}	-.0074935	.0029665	-2.53	0.012	-.0133209	-.0016661
$P65_{t-4}$	-.0006393	.0009763	-0.65	0.513	-.0025571	.0012785
PBA_{t-4}	-.0000457	.0005641	-0.08	0.935	-.0011538	.0010624
PAA_{t-4}	.0011342	.0007483	1.52	0.130	-.0003357	.0026041
PHO_{t-4}	.0005631	.0004719	1.19	0.233	-.000364	.0014902
CRI_{t-4}	-.0002559	.0003548	-0.72	0.471	-.0009529	.0004411
DD_t	-.0103402	.0123703	-0.84	0.404	-.0346408	.0139604
$CONSOL_t$	.0084982	.0121881	0.70	0.486	-.0154445	.0324409
$INTRA_t$	.0132196	.0275109	0.48	0.631	-.0408238	.067263
$FMG1_t$	.0304552	.0167809	1.81	0.070	-.0025099	.0634202
$FMG2_t$	.0269351	.0190017	1.42	0.157	-.0103924	.0642627
$PMTL_{t-1}$_W2	.0005413	.0031639	0.17	0.864	-.0056739	.0067565
POP_{t-1}_W2	-.0008071	.0009776	-0.83	0.409	-.0027275	.0011133
$POPS_{t-1}$_W2	2.02e-06	5.93e-06	0.34	0.733	-9.63e-06	.0000137
$POPD_{t-1}$_W2	.0079487	.0029769	2.67	0.008	.0021008	.0137965
POV_{t-1}_W2	.02875	.0051541	5.58	0.000	.0186252	.0388749
RBP_{t-1}_W2	-.0004526	.0001201	-3.77	0.000	-.0006886	-.0002166
$P65_{t-4}$_W2	-.0016334	.0025972	-0.63	0.530	-.0067355	.0034687
PAA_{t-4}_W2	.0341934	.0098801	3.46	0.001	.0147846	.0536022
PHO_{t-4}_W2	.0018903	.0010921	1.73	0.084	-.0002551	.0040356
CRI_{t-4}_W2	-.0045771	.0007721	-5.93	0.000	-.0060939	-.0030603
STR_{t-1}	.0560272	.0212951	2.63	0.009	.0141945	.0978599
$PCTL_{t-1}$	.027204	.0102739	2.65	0.008	.0070215	.0473864
$POPC_{t-1}$	-.0002674	.0000264	-10.11	0.000	-.0003193	-.0002154
$INCC_{t-1}$	-.0101898	.0005808	-17.55	0.000	-.0113307	-.0090489
_cons	.7278833	.1177086	6.18	0.000	.4966526	.9591141

Included instruments: $PMTL_{t-1}$ $PMSA_{t-1}$ POP_{t-1} $POPS_{t-1}$ $POPD_{t-1}$ INC_{t-1} POV_{t-1} RBP_{t-1} UER_{t-1} P65 PBA PAA PHO CRI DD CONSOL COORDI FMG1 FMG2 $PMTL_{t-1}$_W2 POP_{t-1}_W2 $POPS_{t-1}$_W2 $POPD_{t-1}$_W2 POV_{t-1}_W2 RBP_{t-1}_W2 P65_W2 PAA_W2 PHO_W2 CRI_W2 STR_{t-1} $PCTL_{t-1}$ $POPC_{t-1}$ $INCC_{t-1}$

Partial R-squared of excluded instruments: 0.6173
Test of excluded instruments:
F(14, 532) = 83.69
Prob > F = 0.0000

B-3. Distance Weights

First-stage regression of MTR_t_W3:

OLS estimation

Estimates efficient for homoskedasticity only
Statistics robust to heteroskedasticity

			Number of obs	=	566
			F(33, 532)	=	61.28
			Prob > F	=	0.0000
Total (centered) SS	=	25.98162379	Centered R2	=	0.7332
Total (uncentered) SS	=	178.6132341	Uncentered R2	=	0.9612
Residual SS	=	6.932105851	Root MSE	=	.1142

MTR_t_W3	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
$PMTL_{t-1}$	-.0000449	.0034157	-0.01	0.990	-.0067548	.0066651
$PMSA_{t-1}$	.004427	.0239215	0.19	0.853	-.0425653	.0514192
POP_{t-1}	.0008828	.0006363	1.39	0.166	-.0003672	.0021328
$POPS_{t-1}$	-2.09e-06	3.19e-06	-0.66	0.512	-8.37e-06	4.18e-06
$POPD_{t-1}$	.001869	.0012551	1.49	0.137	-.0005965	.0043346
INC_{t-1}	.0008564	.0003271	2.62	0.009	.0002137	.001499
POV_{t-1}	-.0003243	.0021957	-0.15	0.883	-.0046376	.0039891
RBP_{t-1}	-.0000677	.0000614	-1.10	0.271	-.0001884	.000053
UER_{t-1}	-.0083898	.0031812	-2.64	0.009	-.0146391	-.0021405
$P65_{t-4}$	.0001725	.0013065	0.13	0.895	-.002394	.002739
PBA_{t-4}	-.0020937	.0005429	-3.86	0.000	-.0031603	-.0010272
PAA_{t-4}	.0005061	.0007238	0.70	0.485	-.0009158	.0019279
PHO_{t-4}	.001762	.0004845	3.64	0.000	.0008102	.0027138
CRI_{t-4}	.0009308	.0002861	3.25	0.001	.0003688	.0014928
DD_t	-.0027037	.0137522	-0.20	0.844	-.0297191	.0243116
$CONSOL_t$	.0009228	.0127939	0.07	0.943	-.02421	.0260557
$INTRA_t$	-.0549128	.0347388	-1.58	0.115	-.1231548	.0133292
$FMG1_t$	-.0053769	.0176509	-0.30	0.761	-.0400509	.0292971
$FMG2_t$	-.041084	.0215001	-1.91	0.057	-.0833195	.0011516
$PMTL_{t-1}$_W3	-.0197832	.0090401	-2.19	0.029	-.0375418	-.0020246
POP_{t-1}_W3	.0078838	.0013973	5.64	0.000	.005139	.0106286
$POPS_{t-1}$_W3	-.0000478	8.68e-06	-5.51	0.000	-.0000648	-.0000307
$POPD_{t-1}$_W3	.0522957	.006335	8.26	0.000	.0398511	.0647403
POV_{t-1}_W3	.0205622	.0058566	3.51	0.000	.0090573	.0320671
RBP_{t-1}_W3	-.0007622	.0001886	-4.04	0.000	-.0011326	-.0003917
$P65_{t-4}$_W3	-.0044173	.0023044	-1.92	0.056	-.0089441	.0001094
PAA_{t-4}_W3	.0038456	.0021132	1.82	0.069	-.0003055	.0079968
PHO_{t-4}_W3	.0031505	.0015571	2.02	0.044	.0000916	.0062093
CRI_{t-4}_W3	.0046629	.0009361	4.98	0.000	.0028241	.0065017
STR_{t-1}	.0787726	.0301693	2.61	0.009	.019507	.1380381
$PCTL_{t-1}$	.0014652	.009787	0.15	0.881	-.0177608	.0206912
$POPC_{t-1}$	-.0000488	.0000309	-1.58	0.115	-.0001096	.000012
$INCC_{t-1}$	.0008829	.0006694	1.32	0.188	-.000432	.0021979
_cons	-.197774	.1500299	-1.32	0.188	-.4924978	.0969498

Included instruments: $PMTL_{t-1}$ $PMSA_{t-1}$ POP_{t-1} $POPS_{t-1}$ $POPD_{t-1}$ INC_{t-1} POV_{t-1} RBP_{t-1} UER_{t-1} P65 PBA PAA PHO CRI DD CONSOL COORDI FMG1 FMG2 $PMTL_{t-1}$_W3 POP_{t-1}_W3 $POPS_{t-1}$_W3 $POPD_{t-1}$_W3 POV_{t-1}_W3 RBP_{t-1}_W3 P65_W3 PAA_W3 PHO_W3 CRI_W3 STR_{t-1} $PCTL_{t-1}$ $POPC_{t-1}$ $INCC_{t-1}$

Partial R-squared of excluded instruments: 0.6232

Test of excluded instruments:

F(14, 532) = 62.14

Prob > F = 0.0000

First-stage regression of STR_t:

OLS estimation

Estimates efficient for homoskedasticity only
Statistics robust to heteroskedasticity

		Number of obs =	566
		F(33, 532) =	335.90
		Prob > F =	0.0000
Total (centered) SS =	168.7782268	Centered R2 =	0.9039
Total (uncentered) SS =	990.6832035	Uncentered R2 =	0.9836
Residual SS =	16.21786763	Root MSE =	.1746

STR_t	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
$PMTL_{t-1}$	.0010187	.0051529	0.20	0.843	-.0091039	.0111413
$PMSA_{t-1}$	.0208021	.024839	0.84	0.403	-.0279924	.0695966
POP_{t-1}	-.0005472	.0006154	-0.89	0.374	-.0017561	.0006616
$POPS_{t-1}$	1.63e-06	2.80e-06	0.58	0.560	-3.86e-06	7.13e-06
$POPD_{t-1}$	-.0043095	.0035701	-1.21	0.228	-.0113228	.0027037
INC_{t-1}	.0045056	.0032743	1.38	0.169	-.0019266	.0109377
POV_{t-1}	.0030196	.0021792	1.39	0.166	-.0012613	.0073005
RBP_{t-1}	-.0000183	.0000379	-0.48	0.629	-.0000928	.0000562
UER_{t-1}	-.0074889	.0079	-0.95	0.344	-.0230079	.0080301
$P65_{t-4}$	-.00004	.0022365	-0.02	0.986	-.0044336	.0043535
PBA_{t-4}	-.0031307	.0031856	-0.98	0.326	-.0093885	.0031271
PAA_{t-4}	.0005454	.0008119	0.67	0.502	-.0010496	.0021404
PHO_{t-4}	.0007007	.0006481	1.08	0.280	-.0005725	.0019738
CRI_{t-4}	.0001875	.0004008	0.47	0.640	-.0005999	.000975
DD_t	.0487946	.0427513	1.14	0.254	-.0351875	.1327767
$CONSOL_t$	.0304159	.0173112	1.76	0.079	-.0035908	.0644225
$INTRA_t$	-.27061	.1865732	-1.45	0.148	-.6371205	.0959006
$FMG1_t$	.0274712	.0211935	1.30	0.195	-.0141621	.0691044
$FMG2_t$	.0474649	.0343554	1.38	0.168	-.020024	.1149538
$PMTL_{t-1}$_W3	.0023579	.0070961	0.33	0.740	-.011582	.0162978
POP_{t-1}_W3	.0027458	.0017572	1.56	0.119	-.000706	.0061976
$POPS_{t-1}$_W3	-.0000361	.0000185	-1.95	0.051	-.0000724	2.33e-07
$POPD_{t-1}$_W3	.0190578	.0071305	2.67	0.008	.0050504	.0330651
POV_{t-1}_W3	-.000394	.0059194	-0.07	0.947	-.0120224	.0112343
RBP_{t-1}_W3	-.0000533	.0002256	-0.24	0.813	-.0004965	.0003899
$P65_{t-4}$_W3	.0029078	.0022565	1.29	0.198	-.001525	.0073406
PAA_{t-4}_W3	-.0010025	.0032185	-0.31	0.756	-.007325	.0053201
PHO_{t-4}_W3	.0004297	.0013189	0.33	0.745	-.0021613	.0030206
CRI_{t-4}_W3	.0002477	.0009419	0.26	0.793	-.0016025	.0020979
STR_{t-1}	1.076709	.0403488	26.69	0.000	.9974466	1.155972
$PCTL_{t-1}$	-.0066006	.0158504	-0.42	0.677	-.0377376	.0245365
$POPC_{t-1}$	-.0001003	.0000323	-3.11	0.002	-.0001637	-.0000369
$INCC_{t-1}$	.0008651	.0007991	1.08	0.279	-.0007046	.0024348
_cons	-.1534489	.2499334	-0.61	0.540	-.6444263	.3375285

Included instruments: $PMTL_{t-1}$ $PMSA_{t-1}$ POP_{t-1} $POPS_{t-1}$ $POPD_{t-1}$ INC_{t-1} POV_{t-1} RBP_{t-1}
UER_{t-1} P65 PBA PAA PHO CRI DD CONSOL COORDI FMG1 FMG2
$PMTL_{t-1}$_W3 POP_{t-1}_W3 $POPS_{t-1}$_W3 $POPD_{t-1}$_W3 POV_{t-1}_W3 RBP_{t-1}_W3
P65_W3 PAA_W3 PHO_W3 CRI_W3 STR_{t-1} $PCTL_{t-1}$ $POPC_{t-1}$ $INCC_{t-1}$

Partial R-squared of excluded instruments: 0.8693
Test of excluded instruments:
F(14, 532) = 175.43
Prob > F = 0.0000

First-stage regression of CTR$_t$:

OLS estimation

Estimates efficient for homoskedasticity only
Statistics robust to heteroskedasticity

Number of obs = 566
F(33, 532) = 55.72
Prob > F = 0.0000
Centered R2 = 0.7335
Uncentered R2 = 0.9542
Root MSE = .1035

Total (centered) SS = 21.38244407
Total (uncentered) SS = 124.4604994
Residual SS = 5.699320441

CTR$_t$	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
PMTL$_{t-1}$	-.0085176	.0036092	-2.36	0.019	-.0156077	-.0014275
PMSA$_{t-1}$	.0253244	.0258978	0.98	0.329	-.02555	.0761988
POP$_{t-1}$	.000295	.0004063	0.73	0.468	-.0005032	.0010931
POPS$_{t-1}$	-1.88e-06	1.87e-06	-1.01	0.315	-5.55e-06	1.79e-06
POPD$_{t-1}$	.0018593	.000912	2.04	0.042	.0000677	.0036508
INC$_{t-1}$	.0003841	.0003698	1.04	0.299	-.0003424	.0011105
POV$_{t-1}$	.0075658	.0019867	3.81	0.000	.0036631	.0114685
RBP$_{t-1}$	-.0000495	.0000529	-0.93	0.350	-.0001534	.0000545
UER$_{t-1}$	-.008743	.0031103	-2.81	0.005	-.014853	-.0026331
P65$_{t-4}$	-.00105	.0010484	-1.00	0.317	-.0031096	.0010096
PBA$_{t-4}$	.000197	.0005372	0.37	0.714	-.0008584	.0012523
PAA$_{t-4}$	.0007672	.0007553	1.02	0.310	-.0007166	.002251
PHO$_{t-4}$	.0003978	.0005037	0.79	0.430	-.0005918	.0013874
CRI$_{t-4}$	-.0003265	.0004048	-0.81	0.420	-.0011217	.0004686
DD$_t$	-.0071503	.0120831	-0.59	0.554	-.0308868	.0165862
CONSOL$_t$	.0065781	.0132613	0.50	0.620	-.0194728	.032629
INTRA$_t$	.0111952	.0291162	0.38	0.701	-.0460016	.068392
FMG1$_t$	.0373968	.0160371	2.33	0.020	.0058929	.0689007
FMG2$_t$	.0325232	.0182285	1.78	0.075	-.0032855	.0683319
PMTL$_{t-1}$_W3	-.0053057	.0072049	-0.74	0.462	-.0194592	.0088478
POP$_{t-1}$_W3	-.0008782	.001125	-0.78	0.435	-.0030883	.0013318
POPS$_{t-1}$_W3	-7.71e-07	7.52e-06	-0.10	0.918	-.0000155	.000014
POPD$_{t-1}$_W3	.0201418	.0046677	4.32	0.000	.0109725	.0293112
POV$_{t-1}$_W3	.0204792	.004396	4.66	0.000	.0118437	.0291148
RBP$_{t-1}$_W3	-.0005105	.000149	-3.43	0.001	-.0008032	-.0002178
P65$_{t-4}$_W3	-.0019897	.001516	-1.31	0.190	-.0049678	.0009885
PAA$_{t-4}$_W3	.0041163	.0016668	2.47	0.014	.000842	.0073905
PHO$_{t-4}$_W3	.0032331	.0012189	2.65	0.008	.0008387	.0056276
CRI$_{t-4}$_W3	-.0030691	.0007218	-4.25	0.000	-.0044871	-.0016512
STR$_{t-1}$	.0578928	.0224668	2.58	0.010	.0137582	.1020273
PCTL$_{t-1}$	.0278816	.0102429	2.72	0.007	.0077601	.048003
POPC$_{t-1}$	-.0003235	.0000257	-12.61	0.000	-.0003739	-.0002731
INCC$_{t-1}$	-.0105817	.0005568	-19.01	0.000	-.0116754	-.009488
_cons	.6304826	.1184867	5.32	0.000	.3977235	.8632418

Included instruments: PMTL$_{t-1}$ PMSA$_{t-1}$ POP$_{t-1}$ POPS$_{t-1}$ POPD$_{t-1}$ INC$_{t-1}$ POV$_{t-1}$ RBP$_{t-1}$ UER$_{t-1}$ P65 PBA PAA PHO CRI DD CONSOL COORDI FMG1 FMG2 PMTL$_{t-1}$_W3 POP$_{t-1}$_W3 POPS$_{t-1}$_W3 POPD$_{t-1}$_W3 POV$_{t-1}$_W3 RBP$_{t-1}$_W3 P65_W3 PAA_W3 PHO_W3 CRI_W3 STR$_{t-1}$ PCTL$_{t-1}$ POPC$_{t-1}$ INCC$_{t-1}$

Partial R-squared of excluded instruments: 0.6037
Test of excluded instruments:
F(14, 532) = 63.24
Prob > F = 0.0000

Appendix C. SARMA Municipal Tax Rate Model with County Weights by GMM

Residuals:

Min	1Q	Median	3Q	Max
-0.970340	-0.122338	-0.014918	0.102178	2.857626

Type: GM SAR estimator

Coefficients: (GM standard errors)

	Estimate	Std. Error	z value	Pr(>|z|)
(Intercept)	1.2329e-01	1.6321e-01	0.7554	0.4500098
MTR_t_W4_HAT	3.1050e-01	1.2512e-01	2.4815	0.0130830
STR_t_HAT	3.6268e-01	2.9520e-02	12.2859	2.2e-16
CTR_t_HAT	-3.9751e-01	1.4818e-01	-2.6826	0.0073045
$PMTL_{t-1}$	1.8003e-02	5.6221e-03	3.2022	0.0013636
$PMSA_{t-1}$	-1.1208e-01	5.3249e-02	-2.1048	0.0353073
POP_{t-1}	1.7544e-03	1.1558e-03	1.5180	0.1290228
$POPS_{t-1}$	-6.9584e-06	5.4557e-06	-1.2754	0.2021515
$POPD_{t-1}$	1.6955e-02	3.3777e-03	5.0197	5.175e-07
INC_{t-1}	3.2314e-03	8.5165e-04	3.7943	0.0001481
POV_{t-1}	2.0961e-02	3.8423e-03	5.4552	4.891e-08
RBP_{t-1}	-3.8635e-04	1.2374e-04	-3.1224	0.0017940
UER_{t-1}	1.0827e-02	7.9354e-03	1.3644	0.1724482
$P65_{t-4}$	5.9789e-03	2.2058e-03	2.7105	0.0067176
PBA_{t-4}	-4.8121e-03	1.3475e-03	-3.5711	0.0003555
PAA_{t-4}	3.3207e-03	1.3313e-03	2.4944	0.0126169
PHO_{t-4}	-3.6534e-03	1.0027e-03	-3.6436	0.0002688
CRI_{t-4}	1.1728e-03	6.7682e-04	1.7328	0.0831371
DD_t	6.3221e-02	3.0684e-02	2.0604	0.0393629
$CONSOL_t$	-4.9052e-02	3.6155e-02	-1.3567	0.1748717
$INTRA_t$	-8.5302e-02	6.7235e-02	-1.2687	0.2045408
$FMG1_t$	5.3499e-02	4.1912e-02	1.2765	0.2017937
$FMG2_t$	3.1162e-02	4.6504e-02	0.6701	0.5027895

Lambda: 0.38262 LR test value: 15.666 p-value: 7.5581e-05

Log likelihood: -52.49652 for GM model
ML residual variance (sigma squared): 0.069946, (sigma: 0.26447)
Number of observations: 566
Number of parameters estimated: 25
AIC: 154.99, (AIC for lm: 168.66)

Appendix D. Combined Tax Rate Model by Random-Effects

D-1. First Order Contiguity Based Public Market

```
Random-effects GLS regression                   Number of obs      =      2264
Group variable (i): mid_m                       Number of groups   =       566

R-sq:  within  = 0.4022                         Obs per group: min =         4
       between = 0.3330                                        avg =       4.0
       overall = 0.3354                                        max =         4

Random-effects u_i ~ Gaussian                   Wald chi2(28)      =  14010.69
corr(u_i, X)       = 0 (assumed)                Prob > chi2        =    0.0000

                               (Std. Err. adjusted for 566 clusters in mid_m)
------------------------------------------------------------------------------
             |               Robust
       MSTRt |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
    COMt_PM1 |  -.4881474   .2787197    -1.75   0.080    -1.034428    .0581331
     MSt_PM1 |  -.1189579   .1711856    -0.69   0.487    -.4544756    .2165598
     CONSOLt |  -.1468334   .0773253    -1.90   0.058    -.2983882    .0047214
      INTRAt |  -.9274132   .6818691    -1.36   0.174    -2.263852    .4090257
      CTRt-1 |   1.062962   .1317755     8.07   0.000     .8046863    1.321237
  Ln_PMTLt-1 |   .1069849   .0294621     3.63   0.000     .0492402    .1647297
  Ln_PSTLt-1 |   .4251289   .1056523     4.02   0.000     .2180542    .6322036
     PMSAt-1 |  -.1994119   .0717446    -2.78   0.005    -.3400287   -.0587951
     PSSAt-1 |   .2291594   .1051983     2.18   0.029     .0229744    .4353444
      POPt-1 |   .0001348   .0011796     0.11   0.909    -.0021771    .0024467
     POPDt-1 |   .0035983   .0110152     0.33   0.744    -.0179911    .0251877
      INCt-1 |  -.0006859   .0011383    -0.60   0.547     -.002917    .0015452
   Ln_POVt-1 |   .0410771   .0142657     2.88   0.004     .0131168    .0690375
      RBPt-1 |   -.000072   .0000481    -1.50   0.134    -.0001663    .0000222
      UERt-1 |  -.0569922   .0164544    -3.46   0.001    -.0892422   -.0247422
      PSDt-1 |  -.0007434   .0053842    -0.14   0.890    -.0112963    .0098096
         P65 |  -.0224518   .0063201    -3.55   0.000     -.034839   -.0100645
         PBA |  -.0167268   .0025494    -6.56   0.000    -.0217236     -.01173
         PAA |   .0089585   .0038784     2.31   0.021      .001357      .01656
         PHO |  -.0120378   .0070079    -1.72   0.086    -.0257731    .0016975
         CRI |   -.007083   .0026731    -2.65   0.008    -.0123223   -.0018437
         DDt |  -.0695727   .0430561    -1.62   0.106    -.1539612    .0148157
       FMG1t |  -.1450948   .0544846    -2.66   0.008    -.2518828   -.0383069
       FMG2t |  -.2442115   .1084751    -2.25   0.024    -.4568189   -.0316042
   Year 2002 |  -.0279443   .0107422    -2.60   0.009    -.0489986     -.00689
   Year 2003 |  -.0375518    .030622    -1.23   0.220    -.0975698    .0224662
   Year 2004 |   -.132321   .0361695    -3.66   0.000     -.203212     -.06143
       _cons |   4.679063   .9208913     5.08   0.000     2.874149    6.483977
-------------+----------------------------------------------------------------
     sigma_u |  .57679261
     sigma_e |  .15680528
         rho |  .93117986   (fraction of variance due to u_i)
------------------------------------------------------------------------------
```

D-2. Second Order Contiguity Based Public Market

```
Random-effects GLS regression                   Number of obs      =      2264
Group variable (i): mid_m                       Number of groups   =       566

R-sq:  within  = 0.4002                         Obs per group: min =         4
       between = 0.3386                                        avg =       4.0
       overall = 0.3404                                        max =         4

Random-effects u_i ~ Gaussian                   Wald chi2(28)      =  14225.66
corr(u_i, X)       = 0 (assumed)                Prob > chi2        =    0.0000

                                (Std. Err. adjusted for 566 clusters in mid_m)
```

$MSTR_t$	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
COM_t_PM2	-2.134862	.665717	-3.21	0.001	-3.439643	-.8300804
MS_t_PM2	.7238525	.3507862	2.06	0.039	.0363242	1.411381
$CONSOL_t$	-.1486826	.0761915	-1.95	0.051	-.2980152	.00065
$INTRA_t$	-.9304011	.6916117	-1.35	0.179	-2.285935	.4251329
CTR_{t-1}	1.108104	.1432852	7.73	0.000	.8272703	1.388938
Ln_$PMTL_{t-1}$	.1068212	.0284032	3.76	0.000	.051152	.1624904
Ln_$PSTL_{t-1}$	.4294746	.1094776	3.92	0.000	.2149025	.6440467
$PMSA_{t-1}$	-.2001981	.0748173	-2.68	0.007	-.3468373	-.0535589
$PSSA_{t-1}$	.2186676	.1056096	2.07	0.038	.0116766	.4256586
POP_{t-1}	-.0018587	.0012624	-1.47	0.141	-.004333	.0006156
$POPD_{t-1}$	.0003524	.0111665	0.03	0.975	-.0215336	.0222384
INC_{t-1}	-.0008115	.0012093	-0.67	0.502	-.0031817	.0015586
Ln_POV_{t-1}	.0416043	.014231	2.92	0.003	.0137119	.0694966
RBP_{t-1}	-.0000828	.0000476	-1.74	0.082	-.0001762	.0000105
UER_{t-1}	-.0574259	.0170079	-3.38	0.001	-.0907608	-.024091
PSD_{t-1}	.0001848	.0055353	0.03	0.973	-.0106641	.0110337
P65	-.0220917	.0064144	-3.44	0.001	-.0346637	-.0095197
PBA	-.0172418	.0026466	-6.51	0.000	-.022429	-.0120545
PAA	.0085534	.0039885	2.14	0.032	.000736	.0163708
PHO	-.0120745	.0069499	-1.74	0.082	-.0256961	.0015471
CRI	-.0068628	.0026966	-2.54	0.011	-.0121481	-.0015775
DD_t	-.0658356	.0421477	-1.56	0.118	-.1484435	.0167724
$FMG1_t$	-.1374201	.0553691	-2.48	0.013	-.2459415	-.0288987
$FMG2_t$	-.2024139	.1161462	-1.74	0.081	-.4300563	.0252284
Year 2002	-.0280258	.0114639	-2.44	0.014	-.0504946	-.005557
Year 2003	-.0370847	.0323038	-1.15	0.251	-.1003989	.0262296
Year 2004	-.1339837	.0395814	-3.39	0.001	-.2115619	-.0564056
_cons	4.758707	.9316204	5.11	0.000	2.932765	6.58465
sigma_u	.57457453					
sigma_e	.15651692					
rho	.9309215	(fraction of variance due to u_i)				

D-3. Distance Based Public Market

```
Random-effects GLS regression                   Number of obs      =      2264
Group variable (i): mid_m                       Number of groups   =       566

R-sq:  within  = 0.3992                         Obs per group: min =         4
       between = 0.3412                                        avg =       4.0
       overall = 0.3427                                        max =         4

Random-effects u_i ~ Gaussian                   Wald chi2(28)      =  13837.76
corr(u_i, X)       = 0 (assumed)                Prob > chi2        =    0.0000

                                (Std. Err. adjusted for 566 clusters in mid_m)
```

$MSTR_t$	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
COM_t_PM3	-1.255123	.5745977	-2.18	0.029	-2.381314	-.1289325
MS_t_PM3	-.2182144	.1771557	-1.23	0.218	-.5654332	.1290044
$CONSOL_t$	-.1438275	.0740157	-1.94	0.052	-.2888955	.0012406
$INTRA_t$	-.9205037	.6922318	-1.33	0.184	-2.277253	.4362457
CTR_{t-1}	1.094605	.1419235	7.71	0.000	.81644	1.37277
Ln_PMTL_{t-1}	.0999202	.0277565	3.60	0.000	.0455184	.1543219
Ln_PSTL_{t-1}	.416723	.109855	3.79	0.000	.2014112	.6320348
$PMSA_{t-1}$	-.194643	.0763165	-2.55	0.011	-.3442205	-.0450655
$PSSA_{t-1}$	.2377328	.107745	2.21	0.027	.0265564	.4489091
POP_{t-1}	-.0002869	.001362	-0.21	0.833	-.0029563	.0023825
$POPD_{t-1}$	-.0002272	.0112631	-0.02	0.984	-.0223025	.021848
INC_{t-1}	-.0008318	.0012039	-0.69	0.490	-.0031913	.0015277
Ln_POV_{t-1}	.0420178	.0143006	2.94	0.003	.0139892	.0700465
RBP_{t-1}	-.0000762	.0000486	-1.57	0.117	-.0001716	.0000191
UER_{t-1}	-.058477	.0166946	-3.50	0.000	-.0911978	-.0257562
PSD_{t-1}	.0001291	.0055378	0.02	0.981	-.0107249	.010983
P65	-.0226932	.0063411	-3.58	0.000	-.0351215	-.0102649
PBA	-.0171889	.0025673	-6.70	0.000	-.0222208	-.012157
PAA	.0083005	.0040514	2.05	0.040	.0003599	.016241
PHO	-.0118261	.0068972	-1.71	0.086	-.0253445	.0016923
CRI	-.0067699	.0026155	-2.59	0.010	-.0118962	-.0016437
DD_t	-.0507656	.0423288	-1.20	0.230	-.1337286	.0321974
$FMG1_t$	-.1455603	.0535187	-2.72	0.007	-.250455	-.0406656
$FMG2_t$	-.1901496	.123107	-1.54	0.122	-.4314348	.0511356
Year 2002	-.026842	.0112309	-2.39	0.017	-.0488542	-.0048299
Year 2003	-.0334977	.0313489	-1.07	0.285	-.0949404	.027945
Year 2004	-.1290081	.0385293	-3.35	0.001	-.2045242	-.0534921
_cons	4.723295	.9275537	5.09	0.000	2.905323	6.541267
sigma_u	.57287177					
sigma_e	.15656257					
rho	.9305011	(fraction of variance due to u_i)				

D-4. County Based Public Market

Random-effects GLS regression — Number of obs = 2264
Group variable (i): mid_m — Number of groups = 566

R-sq: within = 0.3991 — Obs per group: min = 4
between = 0.3381 — avg = 4.0
overall = 0.3399 — max = 4

Random-effects u_i ~ Gaussian — Wald chi2(28) = 13633.60
corr(u_i, X) = 0 (assumed) — Prob > chi2 = 0.0000

(Std. Err. adjusted for 566 clusters in mid_m)

MSTR$_t$	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
COM$_t$_PM4	-1.713696	.9441545	-1.82	0.070	-3.564205	.1368126
MS$_t$_PM4	-.8075558	.7211159	-1.12	0.263	-2.220917	.6058054
CONSOL$_t$	-.1602489	.0810472	-1.98	0.048	-.3190986	-.0013993
INTRA$_t$	-.9282862	.6949928	-1.34	0.182	-2.290447	.4338746
CTR$_{t-1}$	1.102998	.1418861	7.77	0.000	.8249063	1.38109
Ln_PMTL$_{t-1}$	.1079044	.0283876	3.80	0.000	.0522657	.1635431
Ln_PSTL$_{t-1}$	.4262939	.1087526	3.92	0.000	.2131428	.639445
PMSA$_{t-1}$	-.2057123	.0745204	-2.76	0.006	-.3517696	-.0596551
PSSA$_{t-1}$	.2406618	.1062939	2.26	0.024	.0323296	.4489941
POP$_{t-1}$	.0007412	.0021599	0.34	0.731	-.0034922	.0049746
POPD$_{t-1}$	-.0006845	.0115066	-0.06	0.953	-.0232371	.021868
INC$_{t-1}$	-.000865	.0012034	-0.72	0.472	-.0032237	.0014937
Ln_POV$_{t-1}$	.0418762	.0143337	2.92	0.003	.0137827	.0699697
RBP$_{t-1}$	-.0000714	.0000487	-1.46	0.143	-.0001668	.0000241
UER$_{t-1}$	-.0583604	.016974	-3.44	0.001	-.0916288	-.025092
PSD$_{t-1}$	-.0000382	.0054619	-0.01	0.994	-.0107434	.0106669
P65	-.0237305	.006204	-3.83	0.000	-.0358901	-.0115708
PBA	-.0172241	.0026401	-6.52	0.000	-.0223985	-.0120497
PAA	.0084321	.0040063	2.10	0.035	.00058	.0162842
PHO	-.0122835	.0070896	-1.73	0.083	-.026179	.0016119
CRI	-.00698	.0027879	-2.50	0.012	-.0124442	-.0015157
DD$_t$	-.059599	.0421806	-1.41	0.158	-.1422713	.0230734
FMG1$_t$	-.153925	.0528688	-2.91	0.004	-.2575459	-.050304
FMG2$_t$	-.2163481	.119063	-1.82	0.069	-.4497073	.017011
Year 2002	-.027787	.0115242	-2.41	0.016	-.050374	-.0051999
Year 2003	-.0357093	.0322965	-1.11	0.269	-.0990093	.0275907
Year 2004	-.1324283	.0395412	-3.35	0.001	-.2099277	-.054929
_cons	4.834726	.9556708	5.06	0.000	2.961646	6.707806
sigma_u	.57385471					
sigma_e	.15582474					
rho	.93132919	(fraction of variance due to u_i)				

Appendix E. Property Value Model by GEE

E-1. First Order Contiguity Based Public Market

GEE population-averaged model		Number of obs =	2264
Group and time vars:	mid_m year	Number of groups =	566
Link:	identity	Obs per group: min =	4
Family:	Gaussian	avg =	4.0
Correlation:	AR(1)	max =	4
		Wald chi2(24) =	26397.07
Scale parameter:	.1563787	Prob > chi2 =	0.0000

(Std. Err. adjusted for clustering on mid_m)

Ln_TPV	Coef.	Semi-robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
$Ln\_COM_t\_PM1$	.122483	.0526908	2.32	0.020	.0192109	.2257551
$Ln\_SM_t\_PM1$	-.1077451	.0574227	-1.88	0.061	-.2202915	.0048013
Ln_TMB_{t-1}	.6039085	.0839324	7.20	0.000	.439404	.7684131
Ln_TSB_{t-1}	.0609752	.0234411	2.60	0.009	.0150315	.1069189
Ln_MSSA_{t-1}	-.1783277	.0241068	-7.40	0.000	-.2255762	-.1310791
Ln_HOS_t	.613361	.0980707	6.25	0.000	.421146	.8055759
Ln_PCIV_t	.0695343	.0306688	2.27	0.023	.0094246	.129644
Ln_MNR	-.0596142	.1502599	-0.40	0.692	-.3541182	.2348898
Ln_HB70	-.0623203	.0394831	-1.58	0.114	-.1397058	.0150652
$POPG_{t-1}$	-.0089651	.0028251	-3.17	0.002	-.0145022	-.003428
Ln_POPD_{t-1}	-.0143865	.0196528	-0.73	0.464	-.0529053	.0241324
Ln_INC_{t-1}	.4849633	.0712371	6.81	0.000	.3453412	.6245854
Ln_POV_{t-1}	-.0688158	.0363236	-1.89	0.058	-.1400088	.0023772
Ln_RBP_{t-1}	.0307969	.0065995	4.67	0.000	.017862	.0437317
Ln_UER_{t-1}	-.0391727	.0321024	-1.22	0.222	-.1020922	.0237467
Ln_CRI	-.0059002	.03297	-0.18	0.858	-.0705203	.0587198
DD_t	-.06042	.0312233	-1.94	0.053	-.1216165	.0007766
$CONSOL_t$	-.0079697	.0307142	-0.26	0.795	-.0681684	.052229
$INTRA_t$	.0641293	.066522	0.96	0.335	-.0662516	.1945101
$FMG1_t$	-.0136724	.030625	-0.45	0.655	-.0736964	.0463516
$FMG2_t$	.0023281	.0453454	0.05	0.959	-.0865472	.0912033
Year 2002	.0333629	.0115607	2.89	0.004	.0107044	.0560214
Year 2003	.1144607	.0264664	4.32	0.000	.0625875	.166334
Year 2004	.2307447	.0205097	11.25	0.000	.1905465	.270943
_cons	2.815648	.3768722	7.47	0.000	2.076992	3.554304

E-2. Second Order Contiguity Based Public Market

GEE population-averaged model		Number of obs =	2264
Group and time vars:	mid_m year	Number of groups =	566
Link:	identity	Obs per group: min =	4
Family:	Gaussian	avg =	4.0
Correlation:	AR(1)	max =	4
		Wald chi2(24) =	26239.09
Scale parameter:	.157581	Prob > chi2 =	0.0000

(Std. Err. adjusted for clustering on mid_m)

Ln_TPV	Coef.	Semi-robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
$Ln\_COM_t\_PM2$	.069979	.0593237	1.18	0.238	-.0462933	.1862513
$Ln\_SM_t\_PM2$	-.0486156	.0577198	-0.84	0.400	-.1617444	.0645132
Ln_TMB_{t-1}	.6095231	.0870124	7.01	0.000	.438982	.7800642
Ln_TSB_{t-1}	.0555747	.0216666	2.56	0.010	.0131089	.0980405
Ln_MSSA_{t-1}	-.1955645	.02435	-8.03	0.000	-.2432896	-.1478394
Ln_HOS_t	.5899327	.1044794	5.65	0.000	.385157	.7947085
Ln_PCIV_t	.0657954	.0312283	2.11	0.035	.0045891	.1270016
Ln_MNR	-.0554566	.1518929	-0.37	0.715	-.3531612	.2422481
Ln_HB70	-.050744	.0419147	-1.21	0.226	-.1328953	.0314072
$POPG_{t-1}$	-.0094645	.0028848	-3.28	0.001	-.0151185	-.0038104
Ln_POPD_{t-1}	-.0272036	.0188809	-1.44	0.150	-.0642095	.0098022
Ln_INC_{t-1}	.4861309	.072507	6.70	0.000	.3440197	.628242
Ln_POV_{t-1}	-.0680534	.0368541	-1.85	0.065	-.1402862	.0041793
Ln_RBP_{t-1}	.0307399	.0065175	4.72	0.000	.0179658	.0435141
Ln_UER_{t-1}	-.0443761	.0339871	-1.31	0.192	-.1109896	.0222373
Ln_CRI	-.0014638	.0341697	-0.04	0.966	-.0684351	.0655076
DD_t	-.0600619	.0312358	-1.92	0.054	-.1212829	.0011591
$CONSOL_t$	-.0151599	.0322804	-0.47	0.639	-.0784283	.0481086
$INTRA_t$	.0815736	.0705818	1.16	0.248	-.0567641	.2199113
$FMG1_t$	-.0201337	.0327641	-0.61	0.539	-.0843501	.0440827
$FMG2_t$	.0082242	.0454048	0.18	0.856	-.0807675	.0972159
Year 2002	.0353643	.0116761	3.03	0.002	.0124795	.0582491
Year 2003	.1181236	.0265482	4.45	0.000	.0660902	.1701571
Year 2004	.2368441	.0202433	11.70	0.000	.1971679	.2765202
_cons	3.0299	.4766571	6.36	0.000	2.095669	3.96413

E-3. Distance Based Public Market

GEE population-averaged model		Number of obs =	2264
Group and time vars:	mid_m year	Number of groups =	566
Link:	identity	Obs per group: min =	4
Family:	Gaussian	avg =	4.0
Correlation:	AR(1)	max =	4
		Wald chi2(24) =	26409.81
Scale parameter:	.1562206	Prob > chi2 =	0.0000

(Std. Err. adjusted for clustering on mid_m)

Ln_TPV	Coef.	Semi-robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
Ln_COM$_t$_PM3	.0983616	.0407122	2.42	0.016	.0185671	.1781561
Ln_SM$_t$_PM3	-.0799394	.0387863	-2.06	0.039	-.1559591	-.0039197
Ln_TMB$_{t-1}$	.594061	.0820057	7.24	0.000	.4333328	.7547893
Ln_TSB$_{t-1}$	.0602542	.0221045	2.73	0.006	.0169302	.1035782
Ln_MSSA$_{t-1}$	-.1779082	.0223141	-7.97	0.000	-.221643	-.1341733
Ln_HOS$_t$	.6208154	.0978214	6.35	0.000	.4290891	.8125418
Ln_PCIV$_t$	.0610965	.0286465	2.13	0.033	.0049505	.1172425
Ln_MNR	-.0937691	.1641609	-0.57	0.568	-.4155185	.2279804
Ln_HB70	-.0747516	.0386999	-1.93	0.053	-.150602	.0010988
POPG$_{t-1}$	-.0095134	.0028427	-3.35	0.001	-.0150851	-.0039418
Ln_POPD$_{t-1}$	-.0551271	.0260059	-2.12	0.034	-.1060978	-.0041564
Ln_INC$_{t-1}$	.4822035	.0705759	6.83	0.000	.3438772	.6205298
Ln_POV$_{t-1}$	-.068045	.0366446	-1.86	0.063	-.1398671	.003777
Ln_RBP$_{t-1}$	.0318787	.0065501	4.87	0.000	.0190407	.0447167
Ln_UER$_{t-1}$	-.0368839	.0326858	-1.13	0.259	-.100947	.0271792
Ln_CRI	.0029007	.0289752	0.10	0.920	-.0538897	.059691
DD$_t$	-.0568093	.0310241	-1.83	0.067	-.1176155	.0039969
CONSOL$_t$	.0060829	.0314033	0.19	0.846	-.0554664	.0676321
INTRA$_t$	.0537487	.0685077	0.78	0.433	-.080524	.1880214
FMG1$_t$	-.0116805	.0306813	-0.38	0.703	-.0718147	.0484536
FMG2$_t$	.008945	.0443004	0.20	0.840	-.0778822	.0957722
Year 2002	.0338732	.0116172	2.92	0.004	.0111039	.0566425
Year 2003	.1148088	.0266259	4.31	0.000	.0626231	.1669946
Year 2004	.2330901	.0201746	11.55	0.000	.1935487	.2726316
_cons	2.907068	.3678848	7.90	0.000	2.186027	3.628108

E-4. County Based Public Market

GEE population-averaged model		Number of obs	= 2264
Group and time vars:	mid_m year	Number of groups	= 566
Link:	identity	Obs per group: min	= 4
Family:	Gaussian	avg	= 4.0
Correlation:	AR(1)	max	= 4
		Wald chi2(24)	= 25703.13
Scale parameter:	.1559573	Prob > chi2	= 0.0000

(Std. Err. adjusted for clustering on mid_m)

Ln_TPV	Coef.	Semi-robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
$Ln\_COM_t\_PM4$	.0946531	.035089	2.70	0.007	.0258799	.1634264
$Ln\_SM_t\_PM4$	-.0821899	.0384821	-2.14	0.033	-.1576135	-.0067663
Ln_TMB_{t-1}	.6031309	.0826672	7.30	0.000	.4411062	.7651556
Ln_TSB_{t-1}	.0608837	.0228197	2.67	0.008	.0161578	.1056095
Ln_MSSA_{t-1}	-.1733901	.0217526	-7.97	0.000	-.2160244	-.1307557
Ln_HOS_t	.6137181	.0972914	6.31	0.000	.4230305	.8044058
Ln_PCIV_t	.0677889	.0295713	2.29	0.022	.0098303	.1257476
Ln_MNR	-.0919241	.1581903	-0.58	0.561	-.4019714	.2181233
Ln_HB70	-.0436935	.0406148	-1.08	0.282	-.1232969	.03591
$POPG_{t-1}$	-.0093346	.0028583	-3.27	0.001	-.0149367	-.0037324
Ln_POPD_{t-1}	-.0404092	.0213448	-1.89	0.058	-.0822443	.0014259
Ln_INC_{t-1}	.4894106	.0692547	7.07	0.000	.3536738	.6251474
Ln_POV_{t-1}	-.070824	.0356033	-1.99	0.047	-.1406052	-.0010429
Ln_RBP_{t-1}	.0310659	.0065613	4.73	0.000	.0182059	.0439259
Ln_UER_{t-1}	-.0509973	.0344391	-1.48	0.139	-.1184967	.0165021
Ln_CRI	.005765	.0288683	0.20	0.842	-.0508159	.0623459
DD_t	-.0528193	.0301462	-1.75	0.080	-.1119049	.0062662
$CONSOL_t$	-.0056568	.031402	-0.18	0.857	-.0672036	.0558899
$INTRA_t$	.0420878	.0696061	0.60	0.545	-.0943377	.1785133
$FMG1_t$	-.013481	.0318651	-0.42	0.672	-.0759354	.0489735
$FMG2_t$	.0205257	.042102	0.49	0.626	-.0619928	.1030442
Year 2002	.0340604	.0115716	2.94	0.003	.0113806	.0567402
Year 2003	.1188638	.0267277	4.45	0.000	.0664784	.1712492
Year 2004	.2368965	.0202563	11.69	0.000	.1971948	.2765982
_cons	2.599517	.4594178	5.66	0.000	1.699074	3.499959

Appendix F. Property Value Model by Random-Effects

F-1. First Order Contiguity Based Public Market

Random-effects GLS regression		Number of obs =	2264
Group variable: mid_m		Number of groups =	566
R-sq:	within = 0.1293	Obs per group: min =	4
	between = 0.9686	avg =	4.0
	overall = 0.9194	max =	4
Random-effects u_i ~ Gaussian		Wald chi2(26) =	3.14e+06
corr(u_i, X)	= 0 (assumed)	Prob > chi2 =	0.0000

(Std. Err. adjusted for 566 clusters in mid_m)

Ln_TPV_t	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
$Ln\_COM_t\_PM1$	.1306045	.0494838	2.64	0.008	.0336179	.227591
$Ln\_MS_t\_PM1$	-.1244789	.0560767	-2.22	0.026	-.2343873	-.0145706
$CONSOL_t$	-.0102439	.0296481	-0.35	0.730	-.0683531	.0478652
$INTRA_t$	.0672547	.0639189	1.05	0.293	-.058024	.1925334
Ln_TMB_{t-1}	.4578777	.0907554	5.05	0.000	.2800003	.635755
Ln_TSB_{t-1}	.0515002	.0214703	2.40	0.016	.0094191	.0935812
Ln_CTL_{t-1}	.2708602	.0520049	5.21	0.000	.1689324	.3727879
Ln_MSSA_{t-1}	-.1792812	.0203797	-8.80	0.000	-.2192247	-.1393377
Ln_HOS_t	.5347187	.1497883	3.57	0.000	.2411389	.8282985
Ln_PCIV_t	.0709374	.0417869	1.70	0.090	-.0109634	.1528382
Ln_MNR	-.1749991	.1359082	-1.29	0.198	-.4413743	.0913761
Ln_HB70	-.0317375	.0401275	-0.79	0.429	-.1103859	.0469109
$POPG_{t-1}$	-.0041803	.0015996	-2.61	0.009	-.0073154	-.0010452
Ln_POPD_{t-1}	.0010551	.0160286	0.07	0.948	-.0303604	.0324707
Ln_INC_{t-1}	.4082007	.0868368	4.70	0.000	.2380037	.5783977
Ln_POV_{t-1}	-.0600545	.0410535	-1.46	0.144	-.1405179	.0204089
Ln_RBP_{t-1}	.0194323	.0056302	3.45	0.001	.0083974	.0304672
Ln_UER_{t-1}	.012628	.0319111	0.40	0.692	-.0499166	.0751727
Ln_CRI	-.0486406	.034167	-1.42	0.155	-.1156067	.0183255
DD_t	-.0700267	.0314161	-2.23	0.026	-.1316011	-.0084522
$FMG1_t$	-.0104446	.0310397	-0.34	0.737	-.0712813	.0503922
$FMG2_t$	-.0367046	.0460677	-0.80	0.426	-.1269957	.0535865
Year2002	.0264312	.0115485	2.29	0.022	.0037966	.0490659
Year2003	.0803019	.0209536	3.83	0.000	.0392337	.1213702
Year2004	.1917271	.0260279	7.37	0.000	.1407134	.2427407
_cons	3.081023	.4745853	6.49	0.000	2.150853	4.011193
sigma_u	.16111822					
sigma_e	.34534544					
rho	.17875378	(fraction of variance due to u_i)				

F-2. Second Order Contiguity Based Public Market

Random-effects GLS regression		Number of obs =	2264
Group variable: mid_m		Number of groups =	566
R-sq:	within = 0.1291	Obs per group: min =	4
	between = 0.9681	avg =	4.0
	overall = 0.9190	max =	4
Random-effects u_i ~ Gaussian		Wald chi2(26) =	3.05e+06
corr(u_i, X)	= 0 (assumed)	Prob > chi2 =	0.0000

(Std. Err. adjusted for 566 clusters in mid_m)

Ln_TPV_t	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
$Ln\_COM_t\_PM2$	.1069473	.0554844	1.93	0.054	-.0018001	.2156948
$Ln\_MS_t\_PM2$	-.0913245	.0546485	-1.67	0.095	-.1984336	.0157846
$CONSOL_t$	-.0184088	.0301851	-0.61	0.542	-.0775705	.0407528
$INTRA_t$	.0896003	.0651557	1.38	0.169	-.0381025	.2173031
Ln_TMB_{t-1}	.4621248	.0914785	5.05	0.000	.2828302	.6414194
Ln_TSB_{t-1}	.0464902	.0198189	2.35	0.019	.0076459	.0853346
Ln_CTL_{t-1}	.2794302	.0514509	5.43	0.000	.1785883	.3802721
Ln_MSSA_{t-1}	-.1878056	.0203411	-9.23	0.000	-.2276734	-.1479377
Ln_HOS_t	.5184801	.1526993	3.40	0.001	.2191949	.8177652
Ln_PCIV_t	.0684352	.04199	1.63	0.103	-.0138636	.150734
Ln_MNR	-.1748452	.1403692	-1.25	0.213	-.4499638	.1002733
Ln_HB70	-.0146161	.0436905	-0.33	0.738	-.1002479	.0710157
$POPG_{t-1}$	-.0041498	.0015952	-2.60	0.009	-.0072763	-.0010233
Ln_POPD_{t-1}	-.0072857	.0149977	-0.49	0.627	-.0366807	.0221092
Ln_INC_{t-1}	.4105715	.087462	4.69	0.000	.2391492	.5819938
Ln_POV_{t-1}	-.0596334	.0418665	-1.42	0.154	-.1416903	.0224234
Ln_RBP_{t-1}	.0197828	.0055369	3.57	0.000	.0089307	.0306349
Ln_UER_{t-1}	.0108319	.0324416	0.33	0.738	-.0527524	.0744162
Ln_CRI	-.0479006	.0353007	-1.36	0.175	-.1170887	.0212874
DD_t	-.0686994	.0312212	-2.20	0.028	-.1298918	-.007507
$FMG1_t$	-.0159594	.0324349	-0.49	0.623	-.0795308	.0476119
$FMG2_t$	-.0287357	.0460943	-0.62	0.533	-.1190789	.0616075
Year2002	.0268142	.0115757	2.32	0.021	.0041262	.0495022
Year2003	.0808034	.0211561	3.82	0.000	.0393382	.1222686
Year2004	.1930721	.0244277	7.90	0.000	.1451947	.2409495
_cons	3.064937	.5662962	5.41	0.000	1.955017	4.174857
sigma_u	.16362718					
sigma_e	.34534419					
rho	.18333677	(fraction of variance due to u_i)				

F-3. Distance Based Public Market

Random-effects GLS regression		Number of obs =	2264
Group variable: mid_m		Number of groups =	566
R-sq:	within = 0.1301	Obs per group: min =	4
	between = 0.9687	avg =	4.0
	overall = 0.9196	max =	4
Random-effects u_i ~ Gaussian		Wald chi2(26) =	3.20e+06
corr(u_i, X)	= 0 (assumed)	Prob > chi2 =	0.0000

(Std. Err. adjusted for 566 clusters in mid_m)

Ln_TPV$_t$	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
Ln_COM$_t$_PM3	.1006165	.0400463	2.51	0.012	.0221272	.1791057
Ln_MS$_t$_PM3	-.0946486	.0393383	-2.41	0.016	-.1717502	-.017547
CONSOL$_t$	.0071596	.0313745	0.23	0.819	-.0543332	.0686524
INTRA$_t$	.0573687	.0667832	0.86	0.390	-.0735239	.1882614
Ln_TMB$_{t-1}$	.4451647	.0902343	4.93	0.000	.2683088	.6220207
Ln_TSB$_{t-1}$	.0505844	.0203824	2.48	0.013	.0106356	.0905331
Ln_CTL$_{t-1}$	.2728488	.0510939	5.34	0.000	.1727067	.372991
Ln_MSSA$_{t-1}$	-.1776936	.0190211	-9.34	0.000	-.2149743	-.1404128
Ln_HOS$_t$	.5446584	.1498667	3.63	0.000	.250925	.8383917
Ln_PCIV$_t$	.0601853	.0383367	1.57	0.116	-.0149534	.1353239
Ln_MNR	-.2217654	.1505936	-1.47	0.141	-.5169234	.0733925
Ln_HB70	-.045954	.037944	-1.21	0.226	-.1203229	.0284149
POPG$_{t-1}$	-.0045649	.001632	-2.80	0.005	-.0077636	-.0013661
Ln_POPD$_{t-1}$	-.0486057	.0237682	-2.04	0.041	-.0951906	-.0020209
Ln_INC$_{t-1}$	.4054447	.0853562	4.75	0.000	.2381497	.5727398
Ln_POV$_{t-1}$	-.0592787	.0416014	-1.42	0.154	-.1408158	.0222585
Ln_RBP$_{t-1}$	.0202211	.0055202	3.66	0.000	.0094016	.0310406
Ln_UER$_{t-1}$	.0172133	.0326099	0.53	0.598	-.046701	.0811276
Ln_CRI	-.0375233	.0301849	-1.24	0.214	-.0966845	.021638
DD$_t$	-.0641226	.0310497	-2.07	0.039	-.1249788	-.0032663
FMG1$_t$	-.0075282	.0312736	-0.24	0.810	-.0688233	.0537669
FMG2$_t$	-.0280821	.0451281	-0.62	0.534	-.1165316	.0603674
Year2002	.0265303	.0116642	2.27	0.023	.0036689	.0493918
Year2003	.0795807	.0214572	3.71	0.000	.0375253	.1216361
Year2004	.1918297	.0248685	7.71	0.000	.1430884	.240571
_cons	3.160947	.4518661	7.00	0.000	2.275306	4.046588
sigma_u	.16044478					
sigma_e	.34533919					
rho	.17753261	(fraction of variance due to u_i)				

F-4. County Based Public Market

Random-effects GLS regression	Number of obs = 2264
Group variable: mid_m	Number of groups = 566
R-sq: within = 0.1325	Obs per group: min = 4
between = 0.9725	avg = 4.0
overall = 0.9234	max = 4
Random-effects u_i ~ Gaussian	Wald chi2(26) = 3.90e+06
corr(u_i, X) = 0 (assumed)	Prob > chi2 = 0.0000

(Std. Err. adjusted for 566 clusters in mid_m)

Ln_TPV_t	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
$Ln\_COM_t\_PM4$	.2138732	.0333084	6.42	0.000	.1485899	.2791565
$Ln\_MS_t\_PM4$	-.2167547	.0371445	-5.84	0.000	-.2895565	-.1439529
$CONSOL_t$	.0008167	.0270468	0.03	0.976	-.052194	.0538274
$INTRA_t$	.0006895	.0644809	0.01	0.991	-.1256907	.1270697
Ln_TMB_{t-1}	.3994896	.087601	4.56	0.000	.2277948	.5711845
Ln_TSB_{t-1}	.0571463	.0204134	2.80	0.005	.0171367	.0971559
Ln_CTL_{t-1}	.4006167	.0512972	7.81	0.000	.3000761	.5011573
Ln_MSSA_{t-1}	-.1151046	.0174804	-6.58	0.000	-.1493657	-.0808436
Ln_HOS_t	.5329107	.1358387	3.92	0.000	.2666718	.7991496
Ln_PCIV_t	.0698287	.0387465	1.80	0.072	-.0061131	.1457705
Ln_MNR	-.3272805	.1322563	-2.47	0.013	-.586498	-.068063
Ln_HB70	.0148624	.04122	0.36	0.718	-.0659273	.0956521
$POPG_{t-1}$	-.0020638	.0017177	-1.20	0.230	-.0054303	.0013028
Ln_POPD_{t-1}	-.0262567	.0161605	-1.62	0.104	-.0579307	.0054174
Ln_INC_{t-1}	.3868774	.0762276	5.08	0.000	.2374741	.5362807
Ln_POV_{t-1}	-.0732056	.0379344	-1.93	0.054	-.1475558	.0011445
Ln_RBP_{t-1}	.0181644	.0056556	3.21	0.001	.0070797	.0292492
Ln_UER_{t-1}	.0236343	.0299983	0.79	0.431	-.0351613	.0824299
Ln_CRI	-.0472273	.0273782	-1.72	0.085	-.1008876	.006433
DD_t	-.0581052	.0286032	-2.03	0.042	-.1141664	-.0020439
$FMG1_t$	-.0004449	.0268688	-0.02	0.987	-.0531069	.052217
$FMG2_t$	-.0115541	.0375281	-0.31	0.758	-.0851078	.0619996
Year2002	.0155105	.0107364	1.44	0.149	-.0055325	.0365536
Year2003	.0601941	.0225755	2.67	0.008	.0159469	.1044413
Year2004	.1667353	.0228753	7.29	0.000	.1219006	.21157
_cons	1.862778	.5401367	3.45	0.001	.80413	2.921427
sigma_u	.13872006					
sigma_e	.3453101					
rho	.13895821	(fraction of variance due to u_i)				

Bibliography

Advisory Commission on Intergovernmental Relations (ACIR). 1991. *Interjurisdictional Tax and Policy Competition: Good or Bad for the Federal System?* Washington, D.C.: ACIR.

Allers, Maarten A. and J. Paul Elhorst. 2005. Tax Mimicking and Yardstick Competition among Local Governments in the Netherlands. *International Tax and Public Finance* 12(4): 493-513.

Anselin, Luc. 1988. *Spatial Econometrics: Methods and Models*. Dordrecht: Kluwer.

_____. 2005. Exploring Spatial Data with GeoDa™: A Workbook. http://www.csiss.org/clearinghouse/GeoDa/geodaworkbook.pdf. Retrieved Jun 12, 2008.

Anselin, Luc, Anil K. Bera, Raymond Florax, and Mann J. Yoon. 1996. Simple Diagnostic Tests for Spatial Dependence. *Regional Science and Urban Economics* 26(1): 77-104.

Aronsson, Thomas, Johan Lundberg, and Magnus Wikström. 2000. The Impact of Regional Public Expenditures on the Local Decision to Spend. *Regional Science and Urban Economics* 30(2): 185-202.

Baiman, S., Demski, J., 1980. Economically Optimal Performance Evaluation and Control Systems. *Journal of Accounting Research* 18(Supplement): 184-234.

Baird, Robert N. and John H. Landon. 1972. Political Fragmentation, Income Distribution, and the Demand for Government Services. *Nebraska Journal of Economics and Business* 11(Autumn): 171-184.

Banker, R. D., A. Charnes, and W. W. Cooper. 1984. Some Models for Estimating Technical and Scale Inefficiencies in Data Envelopment Analysis. *Management Science* 30(9): 1078-1092.

Barro, Robert J. 1973. The Control of Politicians: An Economic Model. *Public Choice* 14(1): 19-42.

Bates, Laurie J. and Rexford E. Santerre. 2006. Leviathan in the Crosshairs. *Public Choice* 127(1): 133-145.

Baum, C. F., M. E. Schaffer, and S. Stillman. 2007. ivreg2: Stata Module for Extended Instrumental Variables/2SLS, GMM and AC/HAC, LIML, and k-class regression. Boston College Department of Economics, Statistical Software Components S425401. http://ideas.repec.org/c/boc/bocode/s425401.html. Retrieved Jun 12, 2008.

Beck, John H. 1993. Tax Abatement and Tax Rates in a System of Overlapping Revenue-Maximizing Governments. *Regional Science & Urban Economics* 23(5): 645-665.

Beck, N., and J. N. Katz. 1995. What to Do (and Not to Do) with Time-Series Cross-Section Data. *American Political Science Review* 89: 634–647.

Belleflamme, Paul and Jean Hindriks. 2005. Yardstick Competition and Political Agency Problems. *Social Choice & Welfare* 24(1): 155-169.

Benecke, Robert. 2004a. *Municipal Finance Administration in New Jersey*. NJ: Center for Government Services, Rutgers.

_____. 2004b. *The Municipal Budget Process*. NJ: Center for Government Services, Rutgers.

Besley, Timothy and Anne Case. 1995. Incumbent Behavior: Vote-seeking, Tax-setting, and Yardstick Competition. *American Economic Review* 85(1): 25-45.

Besley, Timothy and Harvey S. Rosen. 1998. Vertical Externalities in Tax Setting: Evidence from Gasoline and Cigarettes. *Journal of Public Economics* 70(3): 383-398.

Besley, Timothy and Michael Smart. 2002. Does Tax Competition Raise Voter Welfare? *CEPR Discussion Paper* No. 3131.

Bivand, Roger and Stefan Szymanski. 2000. Modelling the Spatial Impact of the Introduction of Compulsive Competitive Tendering. *Regional Science and Urban Economics* 30(2): 203-219.

Boadway, Robin and Michael Keen. 1996. Efficiency and the Optimal Direction of Federal-State Transfers. *International Tax and Public Finance* 3(2): 137-155.

Boots, Barry and Michael Tiefelsdorf. 2000. Global and Local Spatial Autocorrelation in Bounded Regular Tessellations. *Journal of Geographical Systems* 2(4): 319-348.

Bordignon, Massimo, Floriana Cerniglia, and Federico Revelli. 2003. In Search of Yardstick Competition: A Spatial Analysis of Italian Municipality Property Tax Setting. *Journal of Urban Economics* 54(2): 199-217.

Bosch, Núria and Albert Solé-Ollé. 2007. Yardstick Competition and the Political Costs of Raising Taxes: An Empirical Analysis of Spanish Municipalities. *International Tax and Public Finance* 14(1): 71-92.

Boyne, George A. 1992. Local Government Structure and Performance: Lessons from America? *Public Administration* 70(3): 333-357.

Braun, Peter J. 2002. The Role of the Governing Body in Municipal Finance. In Cupano, Kathleen McKenzie and Mellany Alio Eds. *Powers and Duties of the Municipal Governing Body*. NJ: Center for Government Services, Rutgers.

Brennan, Geoffrey and James Buchanan. 1980. *The Power to Tax: Analytical Foundations of a Fiscal Constitution*. NY: Cambridge University Press.

Brett, Craig and Joris Pinkse. 2000. The Determinants of Municipal Tax Rates in British Columbia. *Canadian Journal of Economics* 33(3): 695-714.

Brueckner, Jan K. 1979. Property Values, Local Public Expenditure, and Economic Efficiency. *Journal of Public Economics* 11(2): 223-245.

_____. 1982. A Test of Allocative Efficiency in the Local Public Sector. *Journal of Public Economics* 19(3): 311-331.

_____. 1998. Testing for Strategic Interaction among Local Governments: The Case of Growth Controls. *Journal of Urban Economics* 44(3): 438-467.

_____. 2000. A Tiebout/Tax-Competition Model. *Journal of Public Economics* 77(2): 285-306.

_____. 2003. Strategic Interaction among Governments: An Overview of Empirical Studies. *International Regional Science Review* 26(2): 175-188.

_____. 2004. Fiscal Decentralization with Distortionary Taxation: Tiebout vs. Tax Competition. *International Tax and Public Finance* 11(2): 133-153.

Brueckner, Jan K. and Luz A. Saavedra. 2001. Do Local Governments Engage in Strategic Property-Tax Competition? *National Tax Journal* 54(2): 203-229.

Brueckner, Jan K. and Thomas L. Wingler. 1984. Public Intermediate Inputs, Property Values, and Allocative Efficiency. Economic Letters 14(2-3): 245-250.

Brülhart, Marius and Mario Jametti. 2006. Vertical versus Horizontal Tax Externalities: An Empirical Test. *Journal of Public Economics* 90(10-11): 2027-2062.

Bucovetsky, Sam. 1991. Asymmetric Tax Competition. *Journal of Urban Economics* 30(2): 167-181.

Bucovetsky, Sam and John Douglas Wilson, 1991. Tax Competition with Two Instruments. *Regional Science and Urban Economics* 21(3): 333-350.

Buettner, Thiess. 2003. Tax Base Effects and Fiscal Externalities of Local Capital Taxation: Evidence from a Panel of German Jurisdictions. *Journal of Urban Economics* 54(1): 110-128.

Campbell, Rebecca J. 2004. Leviathan and Fiscal Illusion in Local Government Overlapping Jurisdictions. *Public Choice* 120(3-4): 301-329.

Case, Anne. 1993. Interstate Tax Competition after TRA86. *Journal of Policy Analysis & Management* 12(1): 136-148.

Center for Government Services. 2001-2006. *New Jersey Legislative District Data Book*. NJ: Center for Local Government Services, Rutgers.

Charnes, A, W.W. Cooper, and E. Rhodes. 1978. Measuring the Efficiency of Decision Making Units. *European Journal of Operational Research* 2(6): 429-444.

Charnes, Chris, William W. Cooper, Arie Y. Lewin, and Lawrence M. Seiford. Eds. 1995. *Data Envelopment Analysis: Theory, Methodology, and Applications.* NJ: Springer.

Chicoine, David L. and Norman Walzer. 1985. *Governmental Structure and Local Public Finance*. MA: Oelgeschlager, Gunn, and Hain Publishers.

Cope, Stephen. 2000. Assessing Rational-Choice Models of Budgeting-From Budget-Maximizing to Bureau-Shaping: A Case Study of British Local Government. *Journal of Public Budgeting, Accounting & Financial Management* 12(4): 598-624.

Crone, Theodore M. 1998/1999. Using State Indexes to Define Economic Regions in the U.S. *Journal of Economic and Social Measurement* 25(3-4): 259-275.

Dahlby, Bev. 1996. Fiscal Externalities and the Design of Intergovernmental Grants. *International Tax and Public Finance* 3(3): 397-412.

Dahlby, Bev and Leonard S. Wilson. 2003. Vertical Fiscal Externalities in a Federation. *Journal of Public Economics* 87(5-6): 917-930.

De Boger, Bruno and Kristiaan Kerstens. 1996a. Cost Efficiency of Belgian Local Governments: A Comparative Analysis of FDH, DEA, and Econometric Approaches. *Regional Science and Urban Economics* 26(2): 145-170.

_____. 1996b. Radial and Nonradial Measures of Technical Efficiency: An Empirical Illustration for Belgian Local Governments Using an FDH Reference Technology. *The Journal of Productivity Analysis* 7(1): 41-62.

_____. 2000. What Is Known about Municipal Efficiency? The Belgian Case and Beyond. In J. Blank Ed. *Public Provision and Performance: Contributions from Efficiency and Productivity Measurement*. Amsterdam: Elsevier. pp. 299-330.

De Borger et al. 1994. Explaining Differences in Productive Efficiency: An Application to Belgian Municipalities. *Public Choice* 80(3-4): 339-358.

Deller, Steven C. 1990. An Application of a Test for Allocative Efficiency in the Local Public Sector. *Regional Science and Urban Economics* 20(3): 395-406.

Deller, Steven C. and David L. Chicoine. 1993. Representative versus Direct democracy: A Test of Allocative Efficiency in Local Government Expenditures. *Public Finance Quarterly* 21(1): 100-114.

Devereux, M. P., B. Lockwood, and M. Redoano. 2007. Horizontal and Vertical Indirect Tax Competition: Theory and Some Evidence from the USA. *Journal of Public Economics* 91(3-4): 451-479.

Dollery, Brian E., Joe L. Wallis, and Andrew Worthington. 2001. The Empirical Measure of Local Government Efficiency. In Dollery, Brian E. and Joe L. Wallis Eds. *The Political Economy of Local Government*. MA: Edward Elgar. pp. 71-113.

Dowding, Keith, Peter John, and Stephen Biggs. 1994. Tiebout: A Survey of the Empirical Literature. *Urban Studies* 31(4-5): 767-797.

Downs, Anthony. 1957. *An Economic Theory of Democracy*. NY: Harper and Row.

Dye, Thomas R. 1990. *American Federalism: Competition among Governments*. MA: Lexington Books.

Eberts, Randall W. and Timothy J. Gronberg. 1988. Can Competition Among Local Governments Constrain Government Spending? *Economic Review - Federal Reserve Bank of Cleveland*. 24(1): 2-9.

_____. 1990. Structure, conduct, and Performance in the Local Public Sector. *National Tax Journal* 43(2): 165-173.

Edwards, Jeremy and Michael Keen. 1996. Tax competition and Leviathan. *European Economic Review* 40(1): 113-134.

Egger, Peter, Michael Pfaffermayr, and Hannes Winner. 2005. An Unbalanced Spatial Panel Data Approach to US State Tax Competition. *Economics Letters* 88(3): 329-335.

Epple, Dennis and Allan Zelenitz. 1981. The Implications of Competition among Jurisdictions: Does Tiebout Need Politics? *Journal of Political Economy* 89(6): 1197-1217.

Esteller-Moré, Álex and Albert Solé-Ollé. 2001. Vertical Income Tax Externalities and Fiscal Interdependence: Evidence from the US. *Regional Science and Urban Economics* 31(2-3): 247-272.

Farrell, M. J. 1957. The Measurement of Productive Efficiency. *Journal of the Royal Statistical Society* 120(3): 253-289.

Feld, Lars P. and Gebhard Kirchgässner. 2001. The Political Economy of Direct Legislation: Direct Democracy and Local Decision-Making. *Economic Policy* 16(33): 329-357.

Ferejohn, John. 1986. Incumbent Performance and Electoral Control. *Public Choice* 50(1): 5-26.

Fiorina, Morris P. 1981. *Retrospective Voting in American National Elections*. CT: Yale University Press.

Fisher, Ronald C. and Leslie E. Papke. 2000. Local Government Responses to Education Grants. *National Tax Journal* 53(1): 153-168.

Flochel, Laurent and Thierry Madies. 2002. Interjurisdictional Tax Competition in a Federal System of Overlapping Revenue Maximizing Governments. *International Tax and Public Finance* 9(2): 121-141.

Flowers, Marilyn R. 1988. Shared Tax Sources in a Leviathan Model of Federalism. *Public Finance Quarterly* 16(1): 67-77.

Forbes, Kevin F. and Ernest M. Zampelli. 1989. Is Leviathan a Mythical Beast? American *Economic Review* 79(3): 568-577.

Fredriksson, Per G. and Daniel L. Millimet. 2002. Strategic Interaction and the Determination of Environmental Policy across U.S. States. *Journal of Urban Economics* 51(1): 101-122.

Freitag, Markus and Adrian Vatter. 2006. Initiatives, Referendums, and the Tax State. *Journal of European Public Policy* 13(1): 89-112.

Gramlich, E. M. 1977. Intergovernmental Grants: A Review of the Empirical Literature. In Wallas E. Oates ED. *The Political Economy of Fiscal Federalism*. MA: Lexington Books. pp. 219-239.

Goodspeed, Timothy J. 2000. Tax Structure in a Federation. *Journal of Public Economics* 75(3): 493-506.

Grossman, Philip J., Panayiotis Mavros, and Robert W. Wassmer. 1999. Public Sector Technical Inefficiency in Large U.S. Cities. *Journal of Urban Economics* 46 (2): 278-299.

Hayashi, Masayoshi and Robin Boadway. 2001. An Empirical Analysis of Intergovernmental Tax Interaction: The Case of Business Income Taxes in Canada. *Canadian Journal of Economics* 34(2): 481-503.

Hayes, Kathy J., Laura Razzolini, and Leola B. Ross. 1998. Bureaucratic Choice and Nonoptimal Provision of Public Goods: Theory and Evidence. *Public Choice* 94(1-2): 1-20.

Hendrick, Rebecca, Yonghong Wu, and Benoy Jacob. 2007. Tax Competition among Municipal Governments: Exit vs. Voice. *Urban Affairs Review* 43(2): 221-255).

Hernández-Murillo, Rubén. 2003. Strategic Interaction in Tax Policies among States. *Review-Federal Reserve Bank of St. Louis* 85(3): 47-56.

Heyndels, Bruno and Jef Vuchelen. 1998. Tax Mimicking among Belgian Municipalities. *National Tax Journal* 51(1): 89-101.

Hirschman, Albert O. 1970. *Exit, Voice, and Loyalty: Responses to Decline in Firms, Organizations, and States*. Cambridge, Massachusetts: Harvard University Press.

Holmström, Bengt. 1982. Moral Hazard in Teams. *The Bell Journal of Economics* 13(2): 324-340.

Hoyt, William H. 1991. Property Taxation, Nash Equilibrium, and Market Power. *Journal of Urban Economics* 30(1): 123-131.

Hughes, P. A. Nold and Mary E. Edwards. 2000. Leviathan vs. Lilliputian: A Data Envelopment Analysis of Government Efficiency. *Journal of Regional Science* 40(4): 649-669.

Kanbur, R. and M. Keen. 1993. Jeux Sans Fontières: Tax Competition and Tax Coordination When Countries Differ in Size. *The American Economic Review* 83(4): 877-892.

Karcher, Alan J. 1998. *New Jersey's Multiple Municipal Madness*. NJ: Rutgers University Press.

Keen, Michael J. 1998. Vertical Tax Externalities in the Theory of Fiscal Federalism. *International Monetary Fund Staff Papers* 45(3): 454-484.

Keen, Michael J. and Christos Kotsogiannis. 2002. Does Federalism Lead to Excessively High Taxes? *American Economic Review* 92(1): 363-370.

_____. 2003. Leviathan and Capital Tax Competition in Federations. *Journal of Public Economic Theory* 5(2): 177-199.

Kelejian, Harry H and Ingmar R. Prucha. 1997. Estimation of Spatial Regression Models with Autoregressive Error by Two Stage Least Squares: A Serious Problem. *International Regional Science Review* 20(): 103–111.

_____. 1999. A Generalized Moments Estimator for the Autoregressive Parameter in a Spatial Model. *International Economic Review* 40(2): 509-533.

Key, V.O., Jr. 1966. *The Responsible Electorate*. MA: Harvard University Press.

Kincaid, John. 1991. The Competitive Chalange to Cooperative Federalism: A Theory of Federal Democracy. In Kenyon, Daphne A. and John Kincaid Eds. *Competition among States and Local Governments: Efficiency and Equity in American Federalism*. Washington, D.C.: The Urban Institute Press. pp. 87-114.

Klick, Jonathan and Francesco Parisi. 2005. Intra-Jurisdictional Tax Competition. *Constitutional Political Economy* 16(4): 387-395.

Inman, Robert P. 1979. The Fiscal Performance of Local Governments: An Interpretative Review. In Mieszkowski, Peter and Mahlon Straszheim Eds. *Current Issues in Urban Economics*. Maryland: The Johns Hopkins University Press. pp.270-321.

Ladd, Helen F. 1992. Mimicking of Local Tax Burdens among Neighboring Counties. *Public Finance Quarterly* 20(4): 450-467.

Lazear, Edward P. and Sherwin Rosen. 1981. Rank-order Tournaments as Optimum Labor Contracts. *Journal of Political Economy* 89(5): 841-864.

Luna, Learnt. 2004. Local Sales Tax Competition and the Effect on County Governments' Tax Rates and Tax Bases. *Journal of the American Taxation Association* 26(1): 43-61.

Mahalanobis, P.C. 1930. On Tests and Measures of Group Divergence. *Journal of the Asiatic Society of Bengal* 26*:* 541-588.

Matsusaka, John G. 1995. Fiscal Effects of the Voter Initiative: Evidence from the Last 30 Years. *The Journal of Political Economy* 103(3): 587-623.

Mieszkowski, Peter and George R. Zodrow. 1989. Taxation and the Tiebout Model: The Differential Effects of Head Taxes, Taxes on Land Rents, and Property Taxes. *Journal of Economic Literature* 27(3): 1098-1146.

Migué, Jean-Luc and Gérard Bélanger. 1974. Toward a General Theory of Managerial Discretion. *Public Choice* 17(1): 27-43.

Mintz, Jack and Henry Tulkens. 1986. Commodity Tax Competition between Member States of a Federation: Equilibrium and Efficiency. *Journal of Public Economics* 29(2): 133-172.

Moran, P.A.P. 1950. Notes on Continuous Stochastic Phenomena. *Biometrika* 37: 17-33.

Mueller, Dennis C. 2003. *Public Choice III*. Cambridge: Cambridge University Press

Musgrave, Richard. 1959. *The Theory of Public Finance: A Study in Public Economy*. NY: McGraw-Hill.

Nelson, Michael A. 1987. Searching for Leviathan: Comment and Extension. *American Economic Review* 77(1): 198-204.

New Jersey Department of Education (NJ DOE). 2000-01 ~ 2007-08. State Aid Summaries. http://www.nj.gov/education/stateaid/. Retrieved December 16, 2008.

_____. 2007. New Jersey *Vital Education Statistics 2005-06*. http://www.nj.gov/education/data/vitaledtoc.htm. Retrieved December 16, 2008.

New Jersey Department of Labor and Workforce Development. 2000-2007. Population and Household Estimates. http://lwd.dol.state.nj.us/labor/lpa/dmograph/est/est_index.html. Retrieved December 16, 2008.

New Jersey Division of Finance, Department of Education. 2008. Budget Guidelines: Fiscal Year 2008-09. http://www.nj.gov/education/finance/fp/audit/0708/guide/guidelines.pdf. Retrieved December 16, 2008.

New Jersey Division of Local Government Services, Department of Community Affairs (NJ DLGS). 1994. Annual Report of the Division of Local Government Services. NJ: NJ DLGS.

______. 2004-05. Municipal Government Financial Information Summaries. http://www.state.nj.us/dca/lgs/annualrpt/armenu.shtml. Retrieved December 16, 2008.

______. 2000-2007a. Property Tax Information. http://www.state.nj.us/dca/lgs/taxes/taxmenu.shtml. Retrieved December 16, 2008

______. 2000-2007b. State Aid to Municipalities. http://www.state.nj.us/dca/lgs/muniaid/aidmenu.shtml. Retrieved December 16, 2008

New Jersey Division of Taxation, Department of Treasury. 2001. *Handbook for New Jersey Assessors*. NJ: New Jersey Division of Taxation.

New Jersey Office of Legislative Services, State Legislature (NJ OLS). 2005. The Assessment of Real Property: Answers to Frequently Asked Questions. OLS Background Report No. 119. http://www.njleg.state.nj.us/PropertyTaxSession/OPI/bg119.pdf. Retrieved December 16, 2008.

New Jersey Statutes Annotated (N.J.S.A.) 18A:7F-38 to 41.

N.J.S.A. 18A:17-14.1.

N.J.S.A. 18A:17-15.

N.J.S.A. 18A:17-31 to 36.

N.J.S.A. 18A:9-2 to 3.

N.J.S.A. 18A:9-4 to 6.

N.J.S.A. 40:103-5(71).

N.J.S.A. 40:41A-2 et seq.

N.J.S.A. 40:69A-1 et seq.

N.J.S.A. 40:70-1 et seq.

N.J.S.A. 40:79-1 et seq.

N.J.S.A. 40:103-5(71).

N.J.S.A. 40A:4-1 et seq.

N.J.S.A. 40A:4-45.1 et seq.

N.J.S.A. 40A:60-1 et seq.

N.J.S.A. 40A:6-1.

N.J.S.A. 40A:61-1 et seq.

N.J.S.A. 40A:62-1 et seq.

N.J.S.A. 40A:63-1 et seq.

N.J.S.A. 40A:63-8 et seq.

N.J.S.A. 54:1.35.3.

N.J.S.A. 54:3-17 et seq.

N.J.S.A. 54:4-2.25.

N.J.S.A. 54:4-23.

Niskanen, William A. 1971. *Bureaucracy and Representative Government*. Chicago: Aldine.

_____. 1975. Bureaucrats and Politicians. *Journal of Law and Economics* 18(3): 617-644.

_____. 1978. Competition among Government Bureaus. In Buchanan et al. Eds. *The Economics of Politics*. London: Institute of Economic Affairs.

_____. 1991. A Reflection on Bureaucracy and Representative Government. In Blais, Andre and Stephane Dion. Eds. *The Budget-Maximizing Bureaucrat: Appraisals and Evidence*. PA: University of Pittsburgh Press. pp. 13-31.

Oates, Wallace E. 1969. The Effects of Property Taxes and Local Public Spending on Property Values: An Empirical Study of Tax Capitalization and the Tiebout Hypothesis. *Journal of Political Economy* 77(6): 957-971.

_____. 1972. *Fiscal Federalism*. New York: Harcourt Brace Jovanovich.

_____. 1985. Searching for Leviathan: An Empirical Study. *American Economic Review* 75(4): 748-757.

Olson, Mancur. 1969. The Principle of Fiscal Equivalence: The Division of Responsibilities among Different Levels of Government. *American Economic Review* 59(2): 479-487.

Pareti, Alice Anne. 2001. *Principles of Municipal Tax Collection I*. NJ: Center for Government Services, Rutgers.

Raimondo, Henry J. 1992. *Economics of State and Local Government*. NY: Praeger.

Rauscher, Michael. 1998. Leviathan and Competition among Jurisdictions: The Case of Benefit Taxation. *Journal of Urban Economics* 44(1): 59-67.

Regional Plan Association. 2005. Fundamental Property Tax Reform: Land Use Implications of New Jersey's Tax Debate. http://www.rpa.org/pdf/propertytax101705.pdf. Retrieved December 16, 2008.

Reock, Ernest C. 1994. *Long Range Property Tax Rate Trends in New Jersey: 1954-1993*. NJ: Center for Government Services, Rutgers.

_____. 2002. Forms of Municipal Governments in New Jersey. In Cupano, Kathleen McKenzie and Mellany Alio Eds.*Powers and Duties of the Municipal Governing Body*. NJ: Center for Government Services, Rutgers.

Revelli, Federico. 2001. Spatial Patterns in Local Taxation: Tax Mimicking or Error Mimicking? *Applied Economics* 33(9): 1101-1107.

_____. 2002a. Local Taxes, National Politics and Spatial Interactions in English District Election Results. *European Journal of Political Economy* 18(2): 281-299.

_____. 2002b. Testing the Tax Mimicking versus Expenditure Spill-over Hypotheses Using English Data. *Applied Economics* 34(14): 1723-1731.

_____. 2003. Reaction or Interaction? Spatial Process Identification in Multi-tiered Government Structures. *Journal of Urban Economics* 53(1): 29-53.

_____. 2006. Performance Rating and Yardstick Competition in Social Service Provision. *Journal of Public Economics* 90(3): 459-475.

Saavedra, Luz Amparo. 2000. A Model of Welfare Competition with Evidence from AFDC. *Journal of Urban Economics* 47(2): 248-279.

Salmon, Pierre. 1987. Decentalisation as an Incentive Scheme. *Oxford Review of Economic Policy* 3(2): 24-43.

Samuelson, Paul. A. 1954. The Pure Theory of Public Expenditures. *Review of Economics and Statistics* 36(4): 387-389.

Santerre, Rexford E. 1986. Representative versus Direct Democracy: A Tiebout Test of Relative Performance. *Public Choice* 48(1): 55-63.

Schaltegger, Christoph A. and Dominique Küttel. 2002. Exit, Voice, and Mimicking Behavior: Evidence from Swiss Cantons. *Public Choice* 113(1-2): 1-23.

Schneider, Mark. 1989. Intermunicipal Competition, Budget Maximizing Bureaucrats, and the Level of Suburban Competition. *American Journal of Political Science* 33(3): 612-628.

Shah, Anwar M. 1992. Empirical Tests for Allocative Efficiency in the Local Public Sector. *Public Finance Quarterly* 20(3): 359-377.

_____. 1994. *The Reform of Intergovernmental Fiscal Relations in Developing and Emerging Market Economies*. Washington, D.C.: World Bank.

Shephard, R. W. 1970. *Theory of Cost and Production Function*. NJ: Princeton University Press.

Shleifer, Andrei. 1985. A Theory of Yardstick Competition. *The RAND Journal of Economics* 16(3): 319-327.

Sigelman, Lee. 1986. The Bureaucrats as Budget Maximizer: An Assumption Examined. *Public Budgeting and Finance* 6(1): 50-59

Silkman, Richard and Dennis R. Young. 1982. X-Efficiency and State Formula Grants. *National Tax Journal* 35(3): 383-397.

Solé-Ollé, Albert. 2003. Electoral Accountability and Tax Mimicking the Effects of Electoral Margins, Coalition, Government Ideology. *European Journal of Political Economy* 19(4): 685-713.

_____. 2006. Expenditure Spillovers and Fiscal Interactions: Empirical Evidence from Local Governments in Spain. *Journal of Urban Economics* 59(1): 32-53.

Special Session Joint Legislative Committee on Constitutional Reform and Citizens Property Tax Constitutional Convention (SSJLCCR). 2006. Constitutional Reform and Citizens Property Tax Constitutional Convention Final Report. http://www.njleg.state.nj.us/PropertyTaxSession/OPI/jccr_final_report.pdf. Retrieved December 16, 2008.

Stansel, Dean. 2006. Interjurisdictional Competition and Local Government Spending in U.S. Metropolitan Areas. *Public Finance Review* 34(2): 173-194.

Stigler, George. 1957. The Tenable Range of Functions of Local Government. In Joint Economic Committee, Subcommittee on Fiscal Policy, U.S. Congress Eds. *Federal Expenditure Policy for Economic Growth and Stability.* Washington, D.C.: U.S. Government Printing Office. pp. 213-219.

Tax Foundation. 2008. State and Local Property Tax Collections per Capita and per Household, Fiscal Year 2006. http://www.taxfoundation.org/files/state&local_proptaxcoll_pc&ph-20080630.pdf. Retrieved December 16, 2008.

Taylor, Lori L. 1995. Allocative Efficiency and Local Government. *Journal of Urban Economics* 37(2): 201–211.

Thanassoulis, Emmanuel. 2001. *Introduction to the Theory and Application of Data Envelopment Analysis: A Foundation Text with Integrated Software*. Norwell, MA: Kluwer Academic Publishers.

Tiebout, Charles. 1956. A Pure Theory of Local Expenditures. *Journal of Political Economy* 64: 431-455.

Turnbull, Geoffrey K. and Salpie S. Djoundourian. 1993. Overlapping Jurisdictions: Substitutes or Complements? *Public Choice* 75(3): 231-245.

U.S. Census Bureau, 2001. *Annual Geographical Mobility Rates, by Type of Movement: 1947-2000*. http://www.census.gov/population/www/socdemo/migrate.html. Retrieved February 15, 2008.

_____. 2003-04 ~ 2005-06. State and Local Government Finances. http://www.census.gov/govs/www/estimate.html. Retrieved December 16, 2008.

_____. 2007. Population Density for States and Puerto Rico. http://www.census.gov/popest/gallery/maps/popsize-2007.html. Retrieved December 16, 2008.

Vermeir, Jan and Bruno Heyndels. 2006. Tax Policy and Yardstick Voting in Flemish Municipal Elections. *Applied Economics* 38(19): 2285-2297.

Von Hagen, Jürgen and Ian Harden. 1996. Budget Processes and Commitment to Fiscal Discipline. *IMF Working Paper*.

Wagoner, Charles B. 1995. Local Fiscal Competition: An Intraregional Perspective. *Public Finance Quarterly* 23(1): 95-114.

Wetzel, Heike. 2006. Economies of Scope in European Railways: An Efficiency Analysis. *Halle Institute for Economic Research*. IWH-Discussion Papers No. 5.

Wildasin, David E. 1986. Interstate Tax Competition: A Comment. *National Tax Journal* 39(3): 353-356.

_____. 1988. Nash Equilibria in Models of Fiscal Competition. *Journal of Public Economics* 35(2): 229-240.

_____. 1989. Interjurisdictional Capital Mobility: Fiscal Externality and a Corrective Subsidy. *Journal of Urban Economics* 25(2):193-212.

Wilson, John Douglas. 1986. A Theory of Interregional Tax Competition. *Journal of Urban Economics* 19(3): 296-316.

_____. 1991. Tax Competition with Interregional Differences in Factor Endowments. *Regional Science and Urban Economics* 21(3): 423-451.

_____. 1995. Mobile Labor, Multiple Tax Instruments, and Tax Competition. *Journal of Urban Economics* 38(3): 333-356.

_____. 1999. Theories of Tax Competition. *National Tax Journal* 52(2): 269-304.

_____. 2005. Welfare-Improving Competition for Mobile Capital. *Journal of Urban Economics* 57(1): 1-18.

Wilson, John Douglas and R. H. Gordon. 2003. Expenditure Competition. *Journal of Public Economic Theory* 5(2): 399-417.

Wilson, P. W. 2007. FEAR: A Package for Frontier Efficiency Analysis with R. *Socio-Economic Planning Sciences*. Forthcoming. http://www.clemson.edu/economics/faculty/wilson/Software/FEAR/FEAR-1.1/fear-1.1_user_guide.pdf. Retrieved October 10, 2008.

Woodbury, Kim and Brian Dollery. 2004. Efficiency Measurement in Australian Local Government: The Case of New South Wales Municipal Water Services. *Review of Policy Research* 21(5): 615-636.

Worthington, Andrew. 2000. Cost Efficiency in Australian Local Government: A Comparative Analysis of Mathematical Programming and Econometric Approaches. *Financial Accountability and Management* 16(3): 201-224.

Wrede, Matthias. 2000. Shared Tax Sources and Public Expenditures. *International Tax and Public Finance* 7(2): 163-175.

_____. 2001. Yardstick Competition to Tame the Leviathan. *European Journal of Political Economy* 17(4): 705-721.

Zax, Jeffrey S. 1989. Is There a Leviathan in Your Neighborhood? *American Economic Review* 79(3): 560-567.

Zodrow, George R. and Peter Mieszkowski. 1986. Pigou, Tiebout, Property Taxation, and the Underprovision of Local Public Goods. *Journal of Urban Economics* 19(3): 356-370.

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Tae Ho Eom, Sock Hwan Lee, and Hau Xu. 2008. Introduction to Panel Data Analysis: Concepts and Practices. In Yang, Kaifeng and Gerald J. Miller. Eds. *Handbook of Research Methods in Public Administration*. 2nd ed. pp.575-594.

Tae Ho Eom and Sock Hwan Lee. Efficiency Implications of Court-Mandated Education Finance Reform in New Jersey. *Policy Studies Journal* (in revising).